13 APRIL 1961

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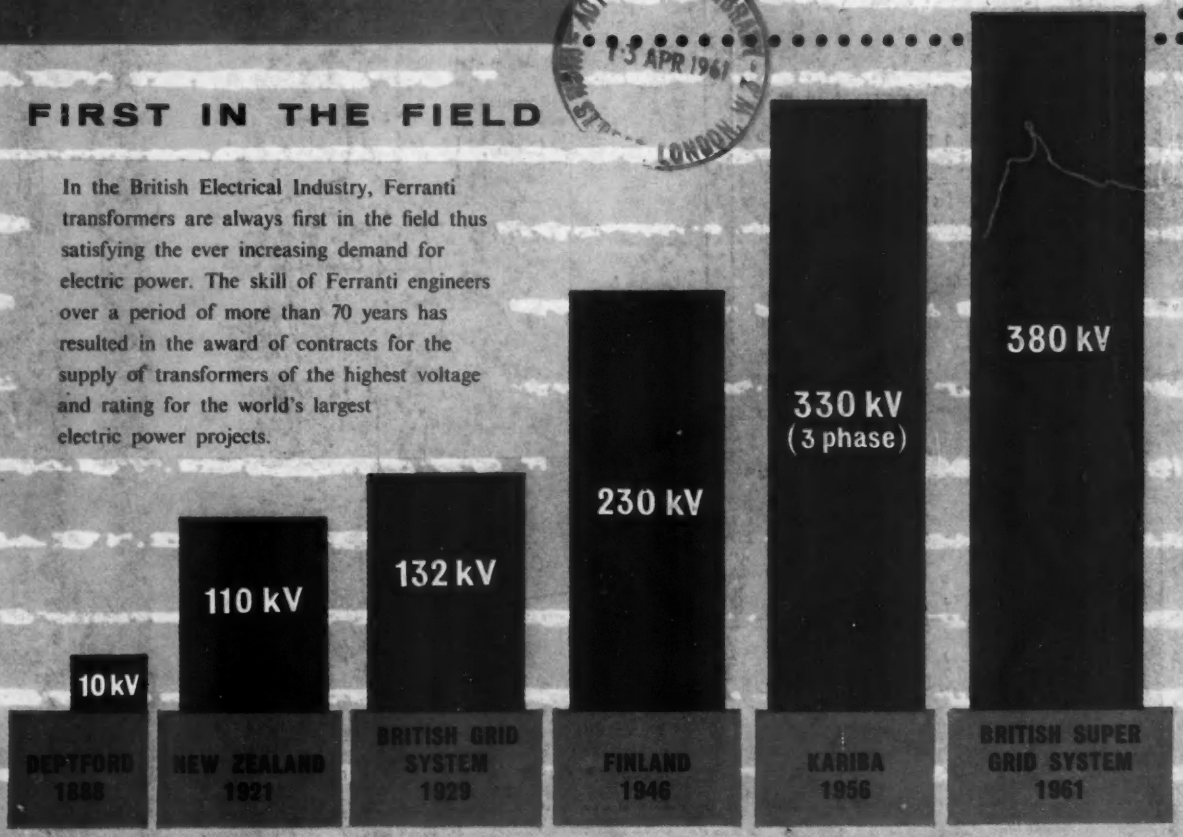

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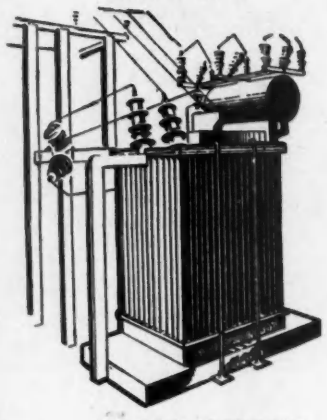

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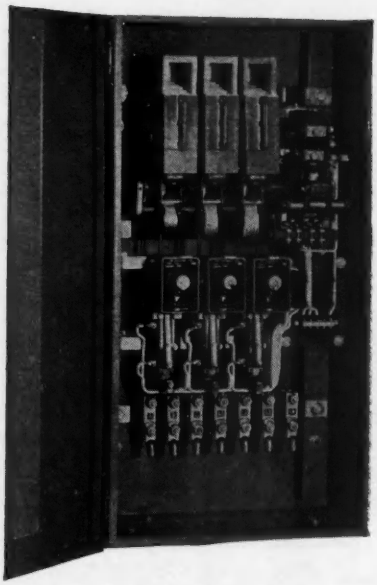

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D.C. amps.	50μA, 1mA, 10mA, 100mA, 1A.
Ohms.	2000 200,000 20 MΩ

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D.C. Volts & Amps.	± 2% of full scale deflection
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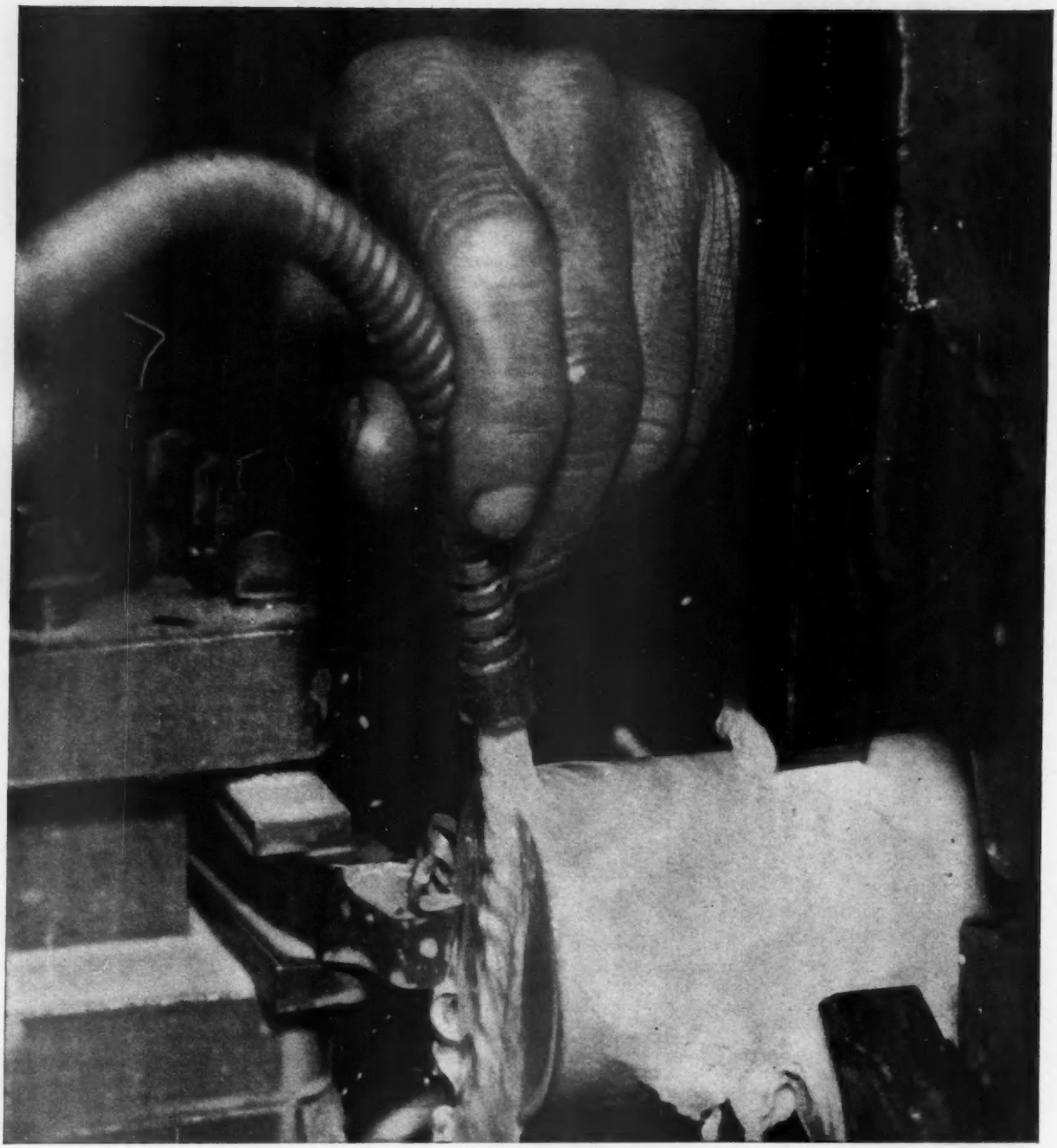

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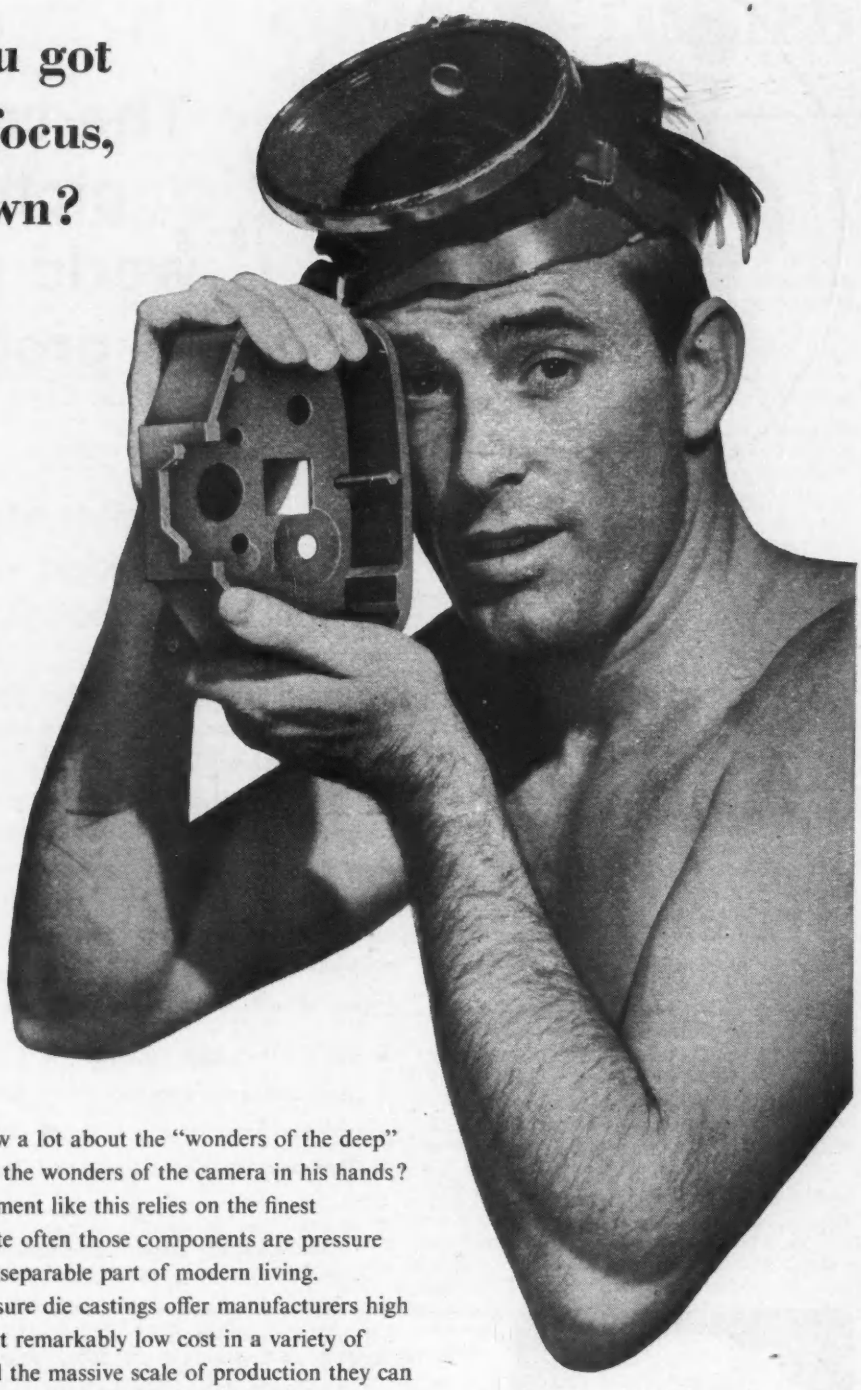

Mr. Brown may know a lot about the "wonders of the deep" but how much about the wonders of the camera in his hands? High precision equipment like this relies on the finest components, and quite often those components are pressure die castings . . . an inseparable part of modern living. Wolverhampton pressure die castings offer manufacturers high quality components at remarkably low cost in a variety of pleasing finishes. And the massive scale of production they can achieve helps the public enjoy a higher standard of living. Wolverhampton pressure die castings in zinc and aluminium point to progress in a big way. Your enquiries would be welcomed.

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1912-1961

THE STORY OF

BELLING & COMPANY LIMITED

No. 39 APRIL 1961

Yearly Report of the Governing Director to all Employees and also to our many customers and friends in the Electrical Trade

This year my Annual Report is written from home instead of on the high seas, and I am glad to say that business during the past year has gone reasonably well. Our sales have reached 23% above those of the previous year and we almost reached our target figure of 25%. Everyone is to be complimented on this splendid result and the efforts necessary for its achievement.

One item which perhaps is not quite so good is that our margin of profit on sales has again fallen a little, mainly due to an increase in wages which came into operation on 1st January, 1961. This latter we have, so far, absorbed ourselves by being satisfied with a reduced profit rather than increasing the price of our goods which might seriously affect our sales in the home market and reduce our chances in the export field. Whether we have done the right thing only the future will show, but increased sales may enable us to improve our profit margin and, under our method of Finance, help us to plough back more money into the business and thus maintain our normal expansion programme. This business, as you all know, has built itself up entirely out of its own profits and, fortunately, owes nothing to anyone. This is the result of the combined efforts of everyone here and at Burnley together with the goodwill of all our customers.

However, we have sufficient profit still left to once again pay out a share to all employees on a similar basis to last year, i.e. the same figure "per point". This will total somewhere around £180,000 for the year, making our total distribution over the last thirteen years to well over the £1,000,000 mark.

Other practical matters in connection with 1960/61 are:
Employment: Now above 3,000 at the two Works and on full time all the year.

Enfield Extensions: The 60,000 sq. ft. started early in 1960 is practically complete and nearly all in use. The top floor, which has a fine view over the district, is our new Canteen, and this will easily be able to deal with 1,000 employees daily.

We have also commenced the new three-storey frontage to our East Building comprising another 16,000 sq. ft., and we expect to commence the new three-storey frontage to our West Building during this summer, when another 24,000 sq. ft. will then be available to us—and that's the lot for which permission can be obtained.

Our building programme at Enfield—when completed—will give us 506,000 sq. ft. of production area. Total site area—10 acres.

Burnley Extensions: The weather has held us up here considerably but we are now fairly advanced with the levelling and foundations of our third 144,000 sq. ft. building, although it looks like being October before it will be of any real value to us. When completed, this will make three buildings of over 100,000 sq. ft. which we have built ourselves plus a separate 100,000 sq. ft. factory we purchased last year. These main buildings, together with other small additions, give us 520,000 sq. ft. with still another 16-acres on which to build. Total site area—37 acres.

Scottish Storage Centre: Levelling, drainage and foundations are being planned. Total site area—8 acres.

Midland Storage Centre: Preliminary building work is being examined and we hope to commence actual construction this year. Total site area—15 acres.

The total area of our freehold land is now some 70 acres, with a total production area at Enfield and Burnley of some 1,025,000 sq. ft. when all present building work is complete.

Fire Production: We have again had a splendid season and our Burnley Works are to be complimented on their increased production which was right up to the space available.

Cooker Production: Enfield have also done extraordinarily well, irrespective of being badly handicapped for space and also by the building and moving operations which have been going on. Our 47AB, 48, "Classic" 60 and Horizontal Classic 70 are all doing well and getting into real streamlined production. Our old 47AB (now 14 years on the market) still has the biggest sale—very reliable, very simple, no gimmicks, and very little "servicing" needed. "My mother still has one of your 47's", we often hear.

Development and Research: This department is now settling down after alterations and the "Corinthian" Fire is their latest contribution. We have several new developments going forward and these will get into our catalogue in due course.

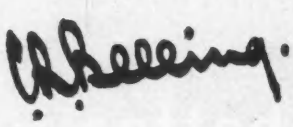
Export: Here we are faced with increasing difficulties due mainly to the uncertain political and economic climate in many of our overseas markets. Nevertheless, we continue to enjoy a substantial share of such business as is available to us and, of course, are constantly on the look-out for fresh opportunities.

Advertising: We try to make this reasonably interesting although it is really quite a puzzle to know in which papers to advertise and exactly what to say. However, as a result of our national and local advertising we have had more requests for our large catalogue than ever before and so, on the whole, it must have been fairly successful.

Catalogues: Our 1961/62 catalogue will be very nearly the same as the 1960/61 edition but with a specially distinctive cover. We hope to be able to maintain our prices unchanged although we very much doubt our ability to do so.

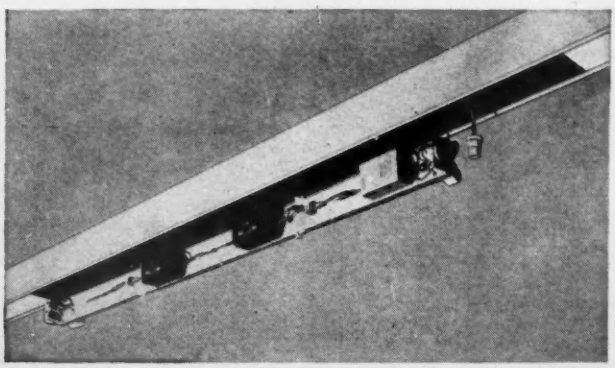
Prospects for 1961/62: We think these will be good if there are no major troubles, so we are once again setting our target at another 25% increase in production and sales, and we further hope by increased efficiency to be able to improve our margin of profit. To reach both these targets we shall want everybody's help—builders, producers, sales and customers, and to get this help we know quite well we shall really have to earn it.

Remember, next year is our 50th anniversary, when we shall have something very special to tell you.



Belling & Co. Ltd., Bridge Works, Enfield, Middx. HOWard 1212

TASKMASTER REGD LIGHTING TRUNKING



Gear tray supported in maintenance position

—the answer in the long run

Benjamin Lighting Trunking reduces installation cost and maintenance to a minimum. The system gives real flexibility with simplicity of design. The stringent specifications include these features:

- Light in weight but immensely strong. Up to 15 ft. centres for suspension with maximum loading.
- One-piece rolled section.
- Easy installation. Joints and suspensions carry the load whilst securing bolts are tightened.
- Lighting units can be moved easily to any position.
- Simple fixing of all fittings and lamps. Easy access to cables, switches, plugs.
- Designed for 8 ft. and 5 ft. standard 'Taskmaster' reflectors and tungsten range.

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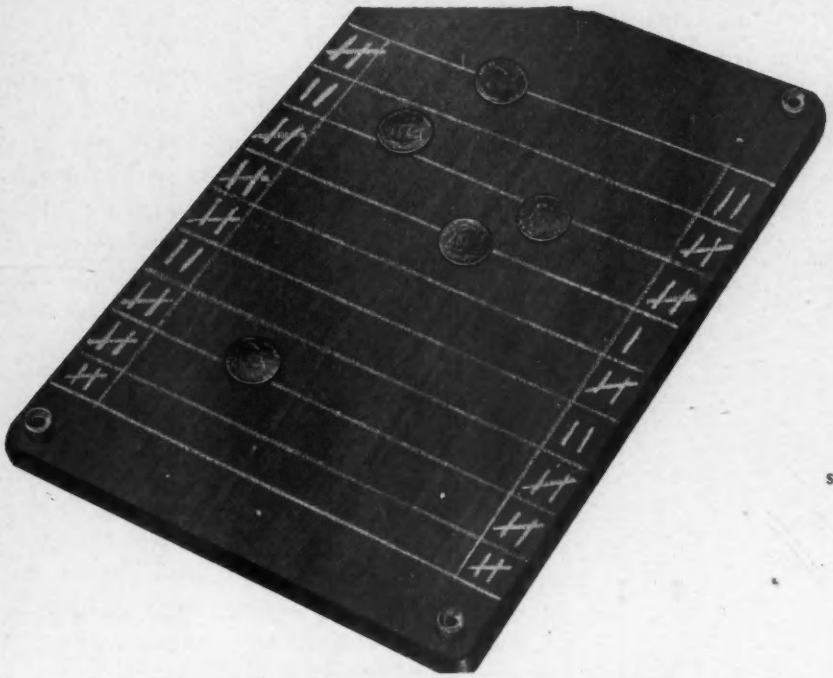

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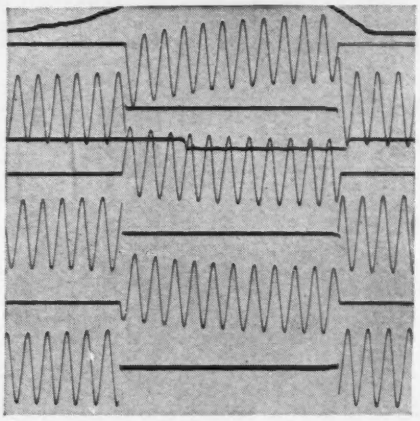
Testing plays a larger part in the development of switchgear than of most plant. And it is not a matter of subjecting a circuit-breaker to a heavy overload to see whether it blows up. On the contrary, to the non-specialist observer a test is an almost ludicrous anti-climax. The build-up is impressive; long preparation, elaborate fire precautions, the switchgear itself as distant as the target in a rifle range and watched through armoured glass. A warning hooter clears the site. Then the test engineer presses a control switch . . . in complete silence absolutely nothing happens, and the test—another 'shot'—is over. But a battery of oscillographs has recorded on photographic film a complete history of everything of importance that happened inside the switch. This is one approach to . . .

This thing called know-how



Any new design or improvement of an existing one involves many such tests of numerous detailed innovations. They are the means by which the designer checks his work as it proceeds. Ready access to test facilities is thus an essential of his work. We are fortunate in having at Chelmsford one of the most up-to-date (ASTA) testing stations in the country, and this has played a most important part in the evolution of all our switchgear. But there is another side to know-how which comes from sheer experience—and we have had 80 years of that.

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S611

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OVER 100 miles of aluminium tube is rolled on to drums like these at Rogerstone, Monmouthshire, every month; it goes to cable makers all over England. More material leaves in the form of strip, for those cable makers who make their own tube by seam welding. These tubes become sheathing for insulated cables.

Four main classes of cable are being made with aluminium sheaths.

Supertension Power Cables

These are filled with gas or oil under pressure. Aluminium sheaths can resist this pressure without reinforcement. Pressure-type cables with aluminium sheaths are notably smaller and lighter, and cheaper, than alternative constructions.

Paper Insulated Power Cables

Aluminium sheathed cables are being increasingly used for power distribution in factories of all kinds. The advantages of aluminium over other cladding materials include—lightness, strength, economy, good resistance to corrosion, and the ability to withstand vibration.

Rubber or Plastic Insulated Wiring Cables

In factories or office buildings, aluminium sheathed cables provide neat and cheap installations; many orders today are repeat orders from satisfied customers.

Telecommunication Cables

Here aluminium's advantage is its good conductivity. An aluminium sheath screens the communication circuits against interference from near-by power cables, and prevents dangerous build-up of induced voltages.

Ask your cable supplier to quote you for aluminium sheathing next time you enquire for cables. For further information write to: Alcan (U.K.) Limited, Aluminium Canada House, 30 Berkeley Square, London, W.1. Telephone MAYfair 9721.

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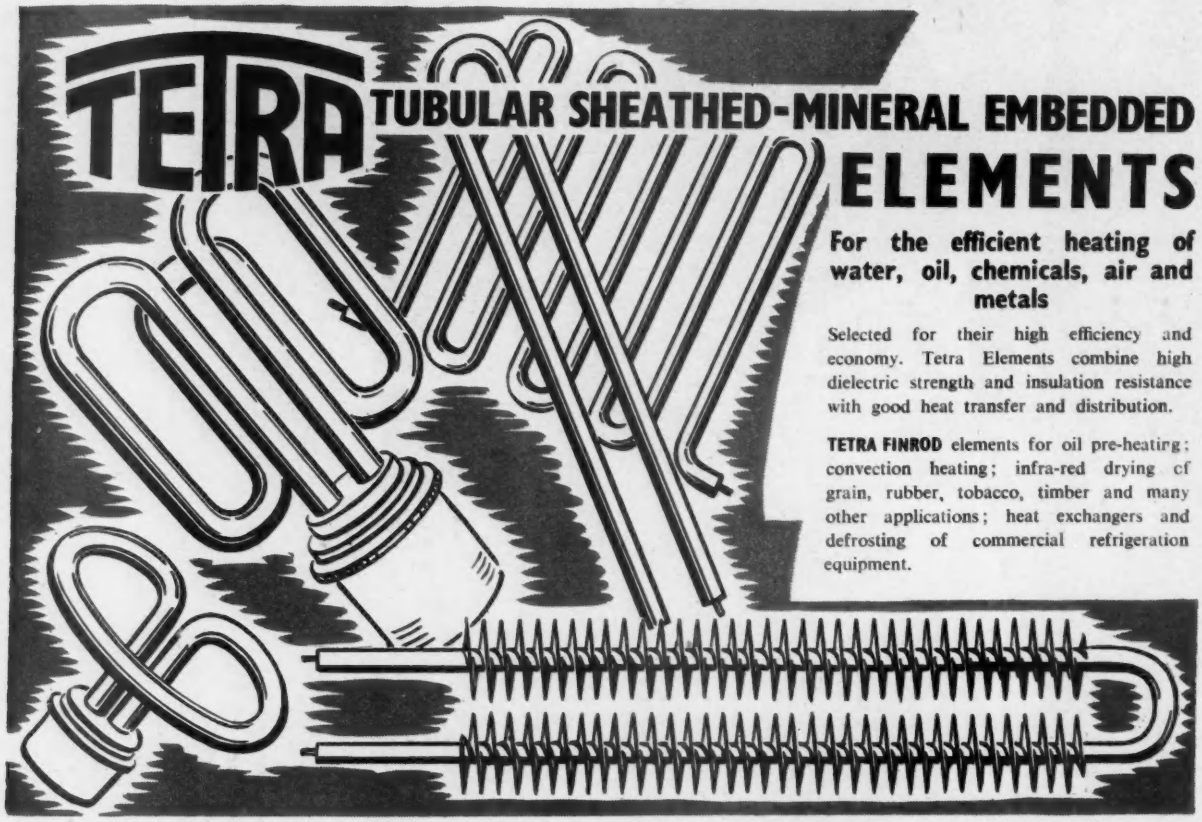

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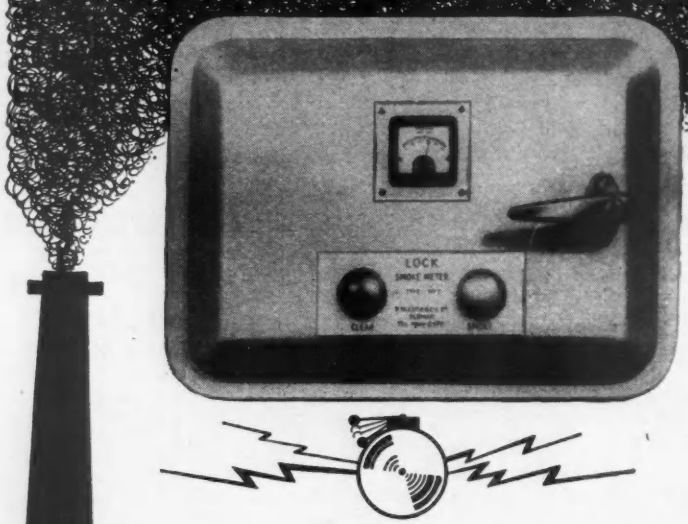

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No project is too large or too difficult for us to consider, and our record of success in solving problems of great complexity and magnitude leads us to believe we shall solve many more. We should like to hear about yours — preferably at an early stage of the designs.

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KARIBA at 330 kV.

All the bushing porcelains for the 330 kV. circuit breakers
All the 330 kV. strain insulators for the substations
and the 330 kV. post insulators for some of the substations
by

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MAIN CONTRACTORS · AEI LTD.
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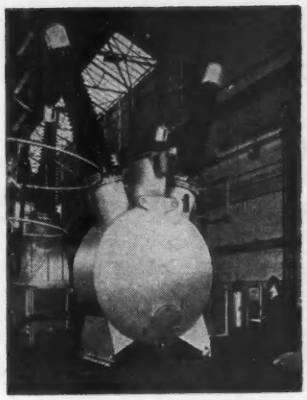

The illustrations show a complete 330 kV. bushing insulator and a 330 kV. circuit breaker, by courtesy of the AEI Ltd.

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NEWS SHEET

Further regional reorganisation by CEGB. All regions renamed, as well as some divisions. Regions to have transmission construction departments; London division absorbed; other divisions retain operating responsibility. (582, 605)

New IES lighting code raises recommended illumination levels, tackles glare as basic factor in lighting installations; combines daylighting and artificial lighting recommendations. (581, 599)

Adjustable power factor compensating plant necessary for supply systems. New generators have restricted capability for MVAr generation; long transmission lines increase light-load leading p.f. problems. 0·93 p.f. lag is best at bulk supply points. MD tariffs may need changing. (581, 588)

Orders in engineering and electrical goods industries 20% up on January, 1960, by beginning of 1961, says Government economic survey. UK exports expected to benefit from expansion in world trade. (582, 608)

More comprehensive operating instructions on switchgear urged by jury at inquest on explosion at YEB's Sawmills substation, Keighley. Death by misadventure verdict on two men, with human error suggested in evidence. (606)

Australia has new wiring rules. Contrasts with IEE regulations include no ring-circuit; outlets permitted in bathrooms; close attention to aluminium. (582, 591)

Significance of tarnish films in promoting contact sparking and molten bridge formation discussed at electrical contacts symposium. Films reduce barrier potential of contact surfaces to release ionising electrons under electric field, but have stabilising effect on molten bridges. (598)

PEOPLE—Dr L. R. Blake joins Brush as director of engineering and appointed to board . . . R. V. Ely (ex-Foster Transformers) becomes consultant to Gresham Transformers . . . W. A. C. Maskell promoted managing director, GEC telecommunications group . . . H. L. Satchell retiring from AEI (Rugby) . . . E. C. E. Lyon appointed electrical traction engineer (Ilford), Eastern Region, BR . . . K. C. Fraser succeeds I. M. Davis (retired) as manager and secretary, Electricity Commission of NSW . . . E. F. Martin appointed managing director, Franco-British Electrical Co. . . . G. Kerensky becomes chief designer (mechanical) English Electric water turbine dept. . . . C. Morley New becomes regional electrical engineer, S. Western Region, CEGB . . . H. J. Fraser is new EPEA president. (594, 596)

NEWS SHEET

Economic and technical factors in choice between copper and aluminium for cables, discussed by C. C. Barnes. Increasing interest in "compact" conductor designs; problems remain with aluminium jointing. (583)

ASEE claims four categories of technical employees exist, says chairman at annual dinner; chartered engineers, supervising engineers and technicians all found in similar positions. (600)

Three Factories Acts consolidated into one Bill now under consideration by House of Lords. (607)

Two more power station sites in Yorkshire selected by CEGB, at Eggborough and Ferrybridge. Each suitable for 2,000 MW capacity. Application to MoP for consent. Third site at Gowdall being studied (607). Wylfa inquiry set for 30 May; 400 kV line also to be considered. (605).

AEI and GEC extend co-operation in lighting and valve fields to metal parts manufacture; glassware already covered. Second joint company formed in four months. (607)

Mains frequency induction heating for experimental boiler and gamma-ray absorption techniques used in important study of high pressure boiler steam-water flow conditions. (592)

3 MW installed load for GPO Telex centre. Electrical features include adaptable fluorescent lighting installation and programmed express lifts. Fleet building houses UK and continental Telex services. (587)

Minister of Power to permit more live working on plant in mines; and to modify technical requirements for electricians taking charge. (605)

BUSINESS—Brentford Transformers joins new group headed by General Hydraulic Power Co. (607) . . . Plessey acquire manufacturing licence for Rini relays (608) . . . Bruce Peebles conclude agreement with REGA Brucker of Germany for electrical equipment for rolling mills (609) . . . Enfield Rolling Mills profit cut by losses on copper stocks and dock strike . . . Midland Electric expanding capacity to meet orders . . . Bylock say credit squeeze caused loss, with bad debts major factor . . . A. Reyrolle lifts earnings by 11½% to £2·88 million and raises dividend to 9¾%. (611)

OVERSEAS—British Columbia Government aim to take over BC Electric Co. . . . Shawinigan to spend $25 million this year . . . Difficult year for Bahamas Electricity due to plant breakdowns and rapid demand growth . . . £2¼ million contract for South Africa's Komati station boilers awarded to Mitchell Eng. . . . $8·4 million loan for transmission developments to Uganda by World Bank . . . In India, Gujarat allot Rs7 crore for third plan schemes . . . Lord Rowallan officially opens Tasmanian hydro scheme. (612, 613)

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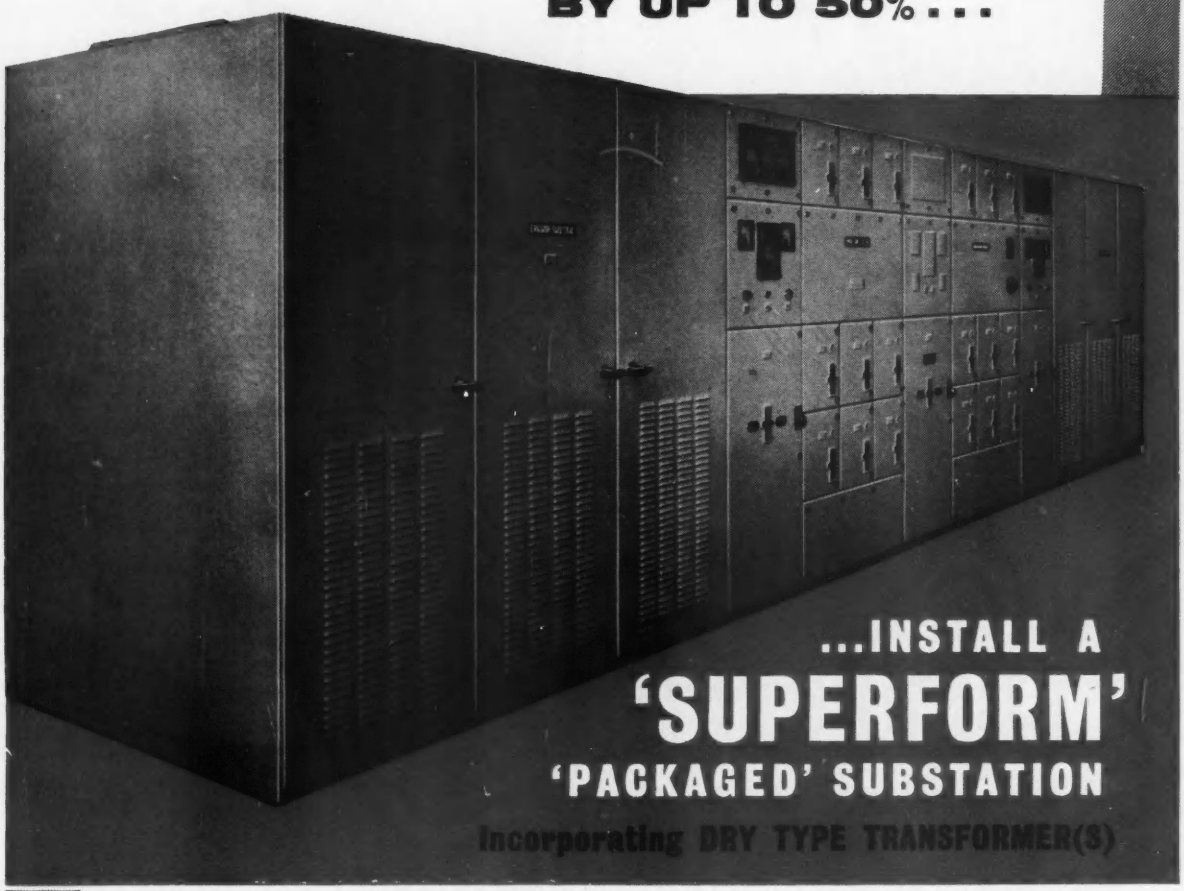

The illustration shows a 'Superform' 'Packaged' Substation for a large chemical works. Two 1,000 kVA Class 'C' dry type transformers are incorporated, one at each end of the equipment. The medium voltage switchboard is supplied through two air circuit-breakers, and the outgoing circuits are controlled by on-load h.r.c. fuse-switches.

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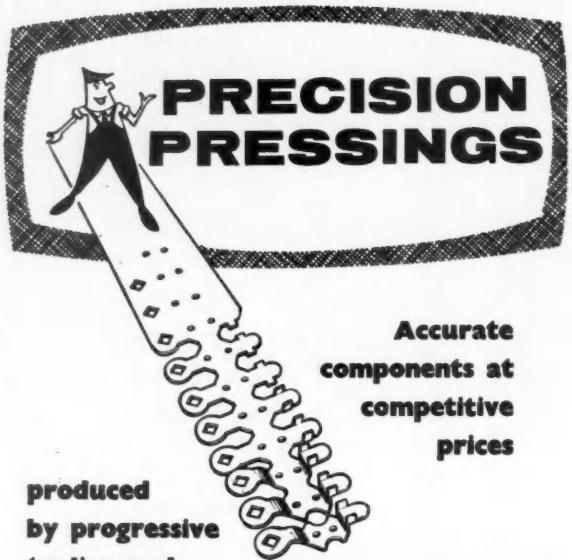

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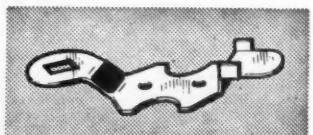

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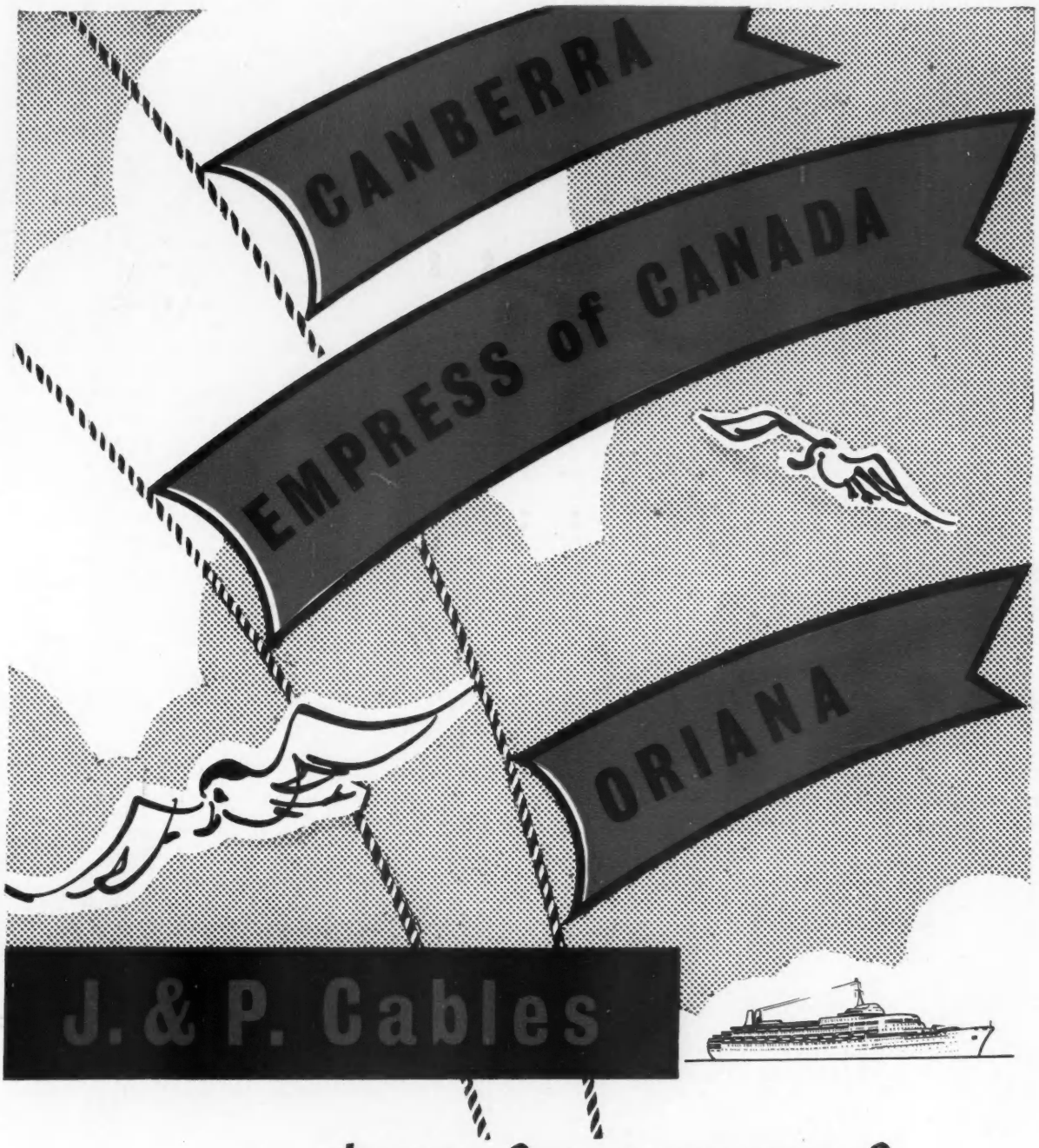

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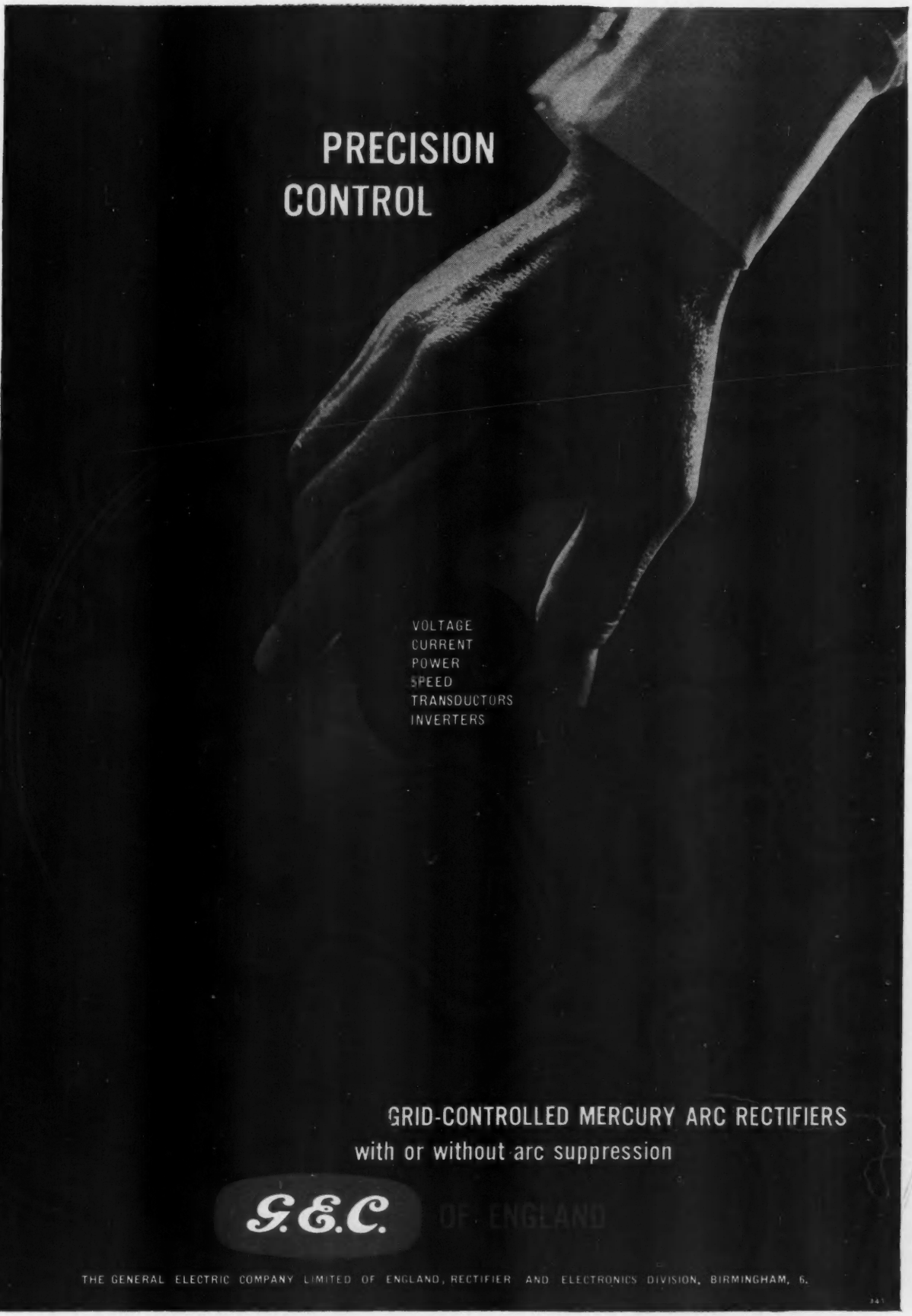
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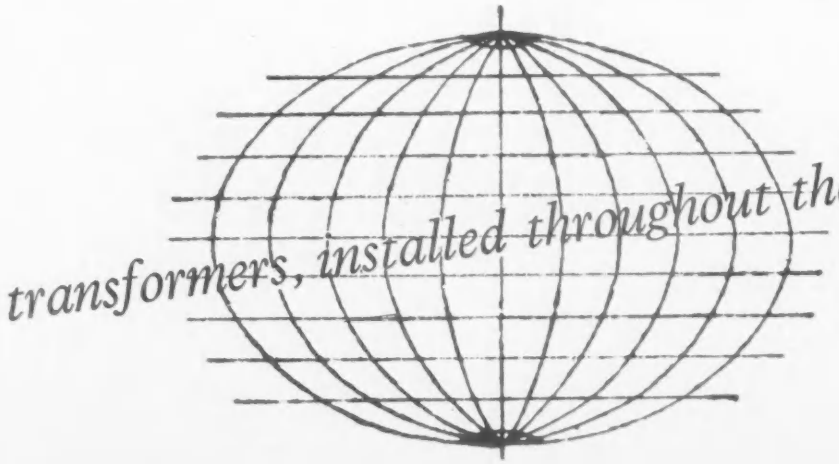

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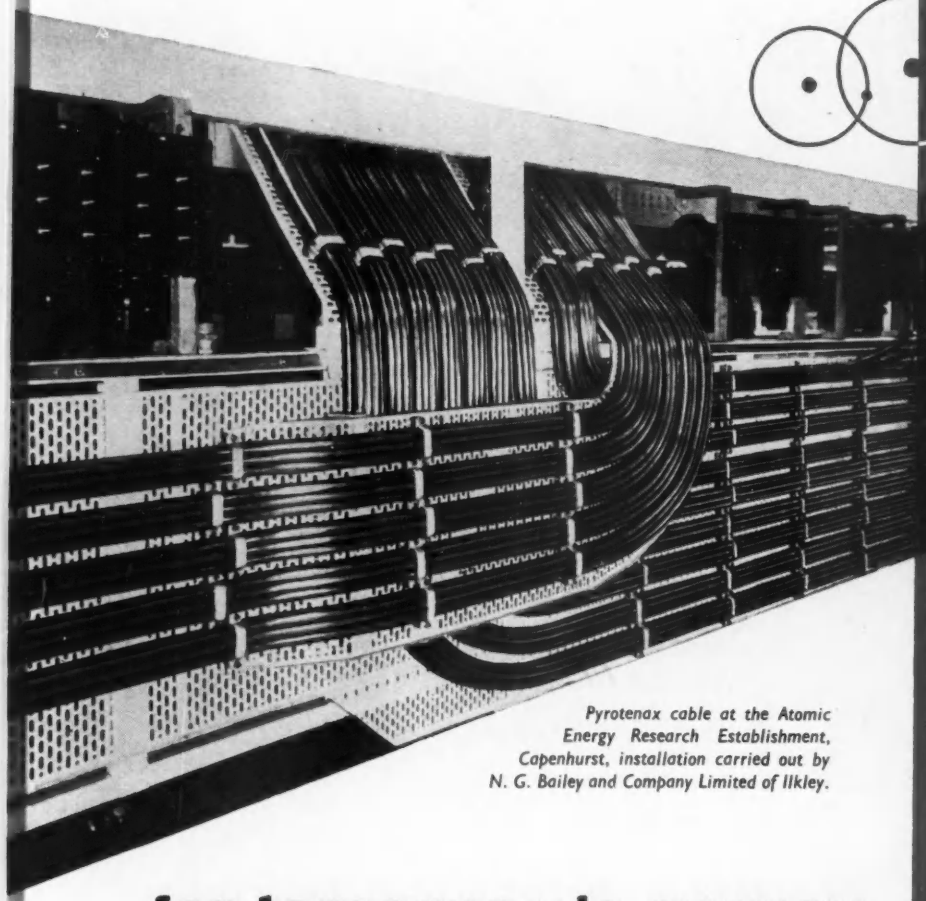

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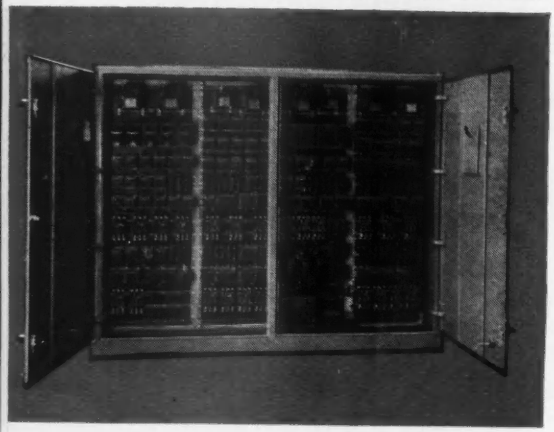
CUSTOM-BUILT CONTROL PANELS



If ever there was a case of "no set answer" it is in the field of automatic controls.

You may require custom-built control panels, or you may prefer to build up your own control systems from individual M.T.E. components, channel framework and standard cabinets.

Whichever way you look at it, you'll find that M.T.E. 'double-service' is the answer.

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Control panel for eight-head rotary indexing machine.

Lower left:
Control panel for industrial refrigeration plant.

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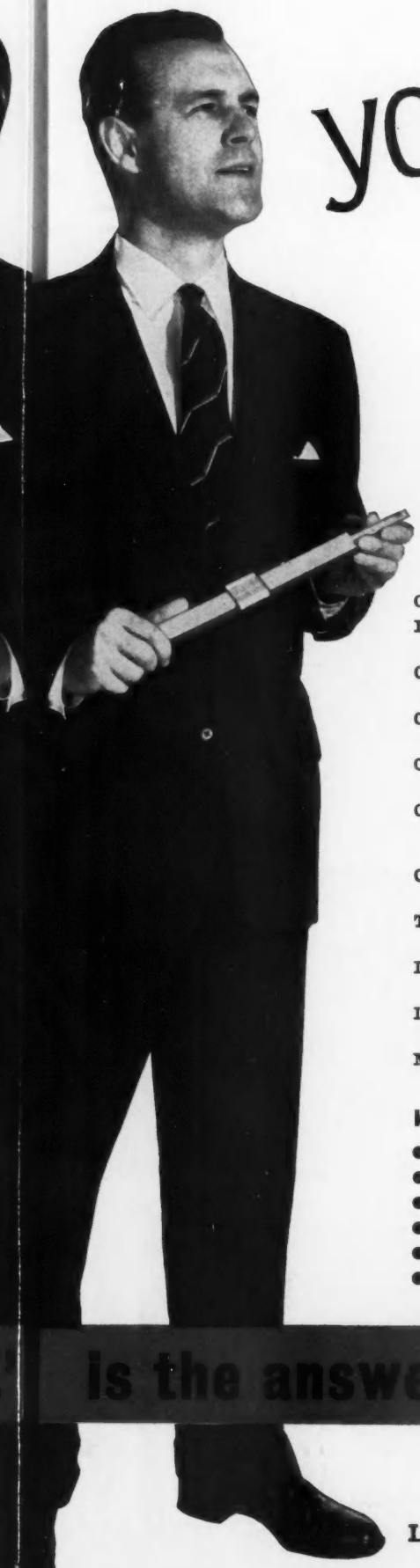
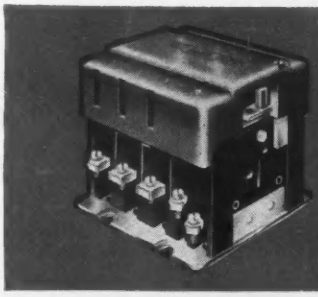
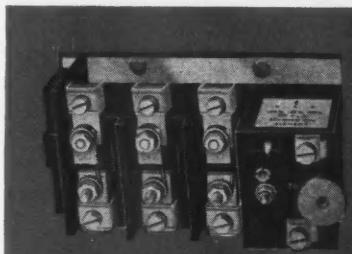


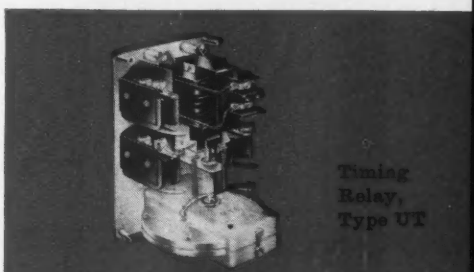
COMPONENTS IN DOUBLE-QUICK TIME



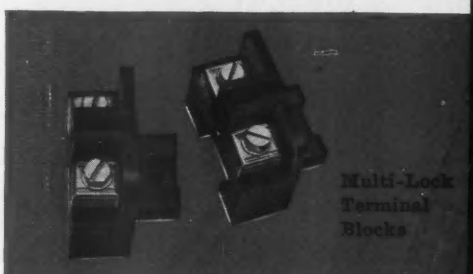
Contactor, 30 Amp, Type UC2



Overload Relay, Thermal, Type UOL11



Timing Relay, Type UT



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Contactors, 30 Amp, Type UC2	7/9 days
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Overload Relays, Thermal, with Single Phasing Protection	7/9 days
Overload Relays, Magnetic	9/11 days
Timing Relays, Type UT	13/21 days
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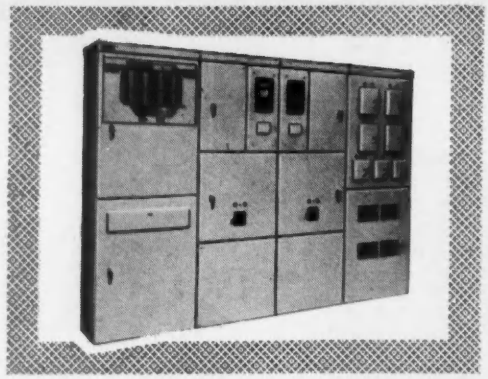
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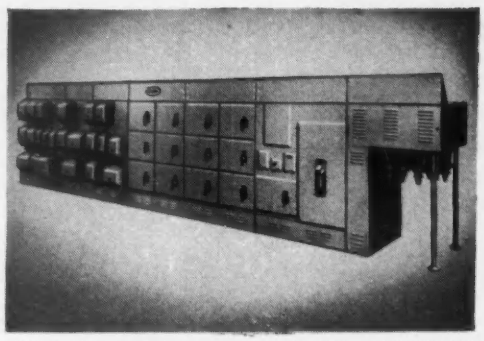
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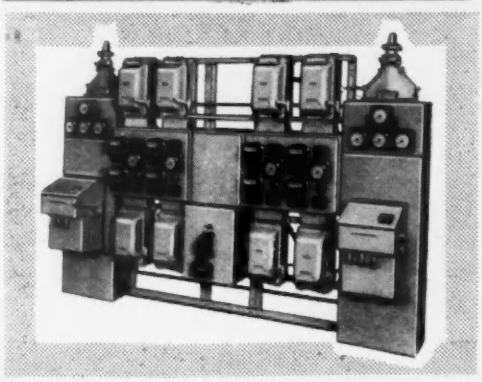
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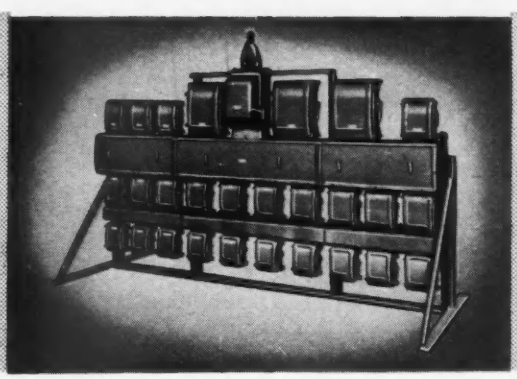
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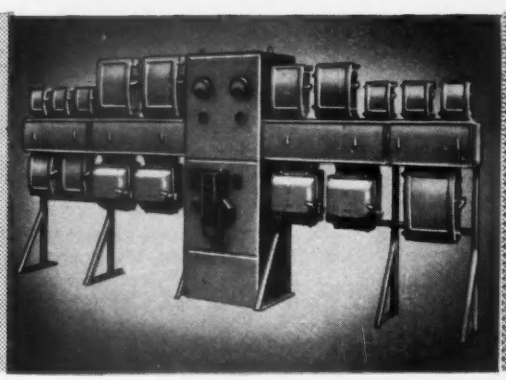
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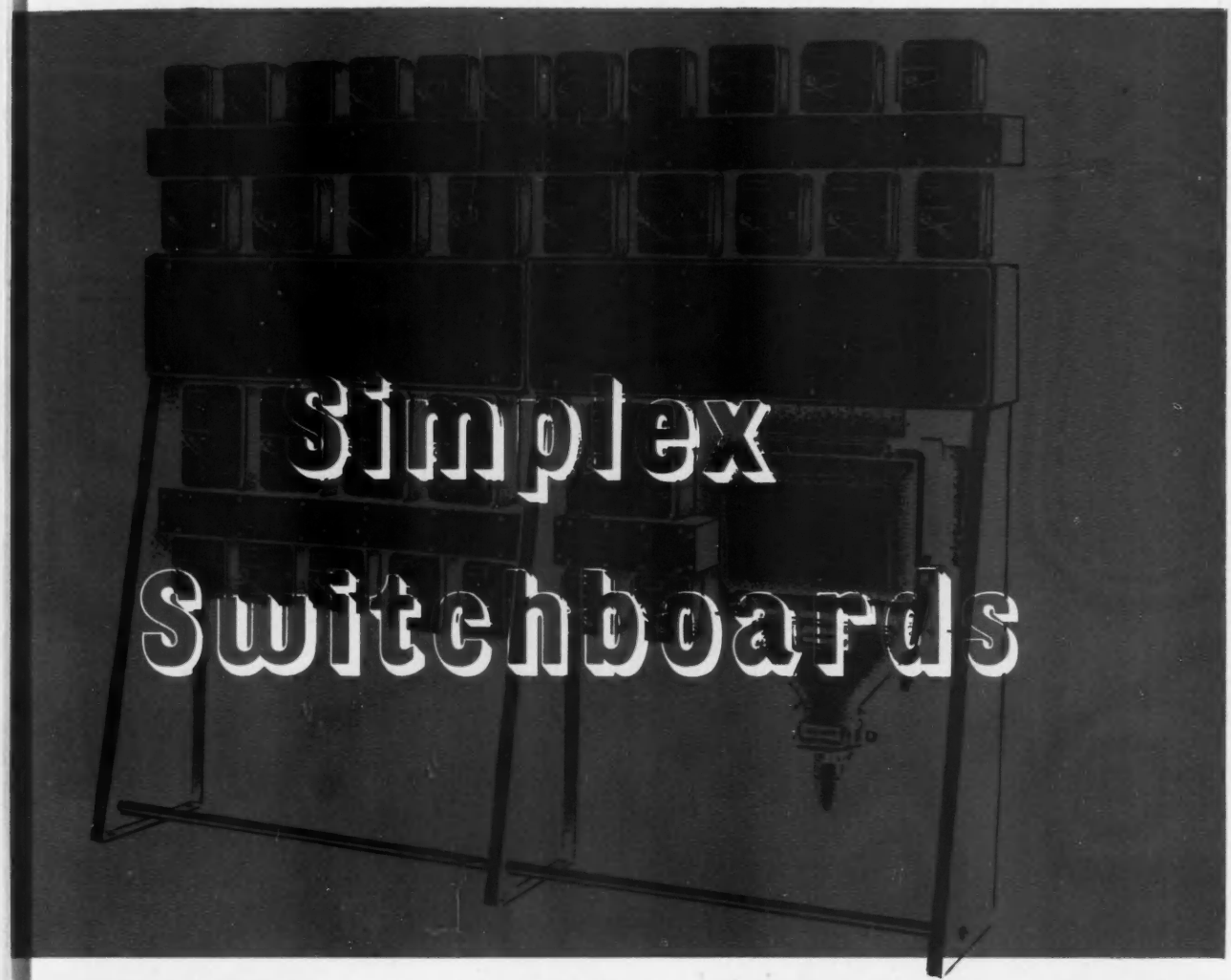
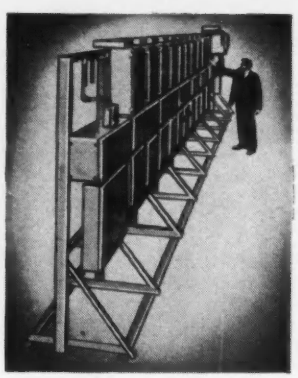
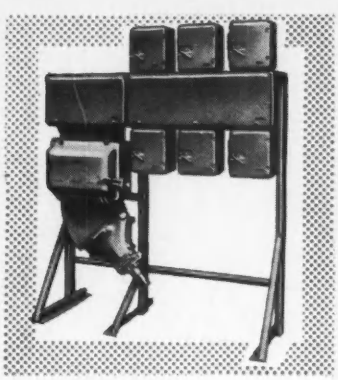


Simplex Switchboards





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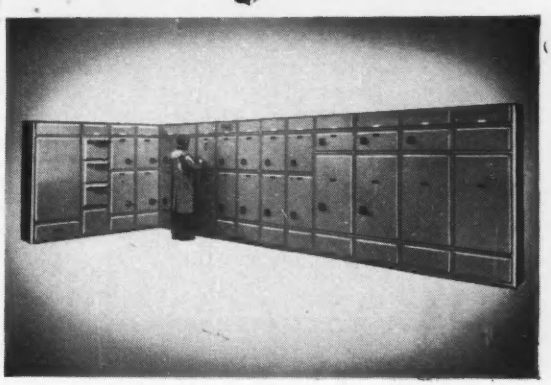

9

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2 Star Monarch and Automatic Control Gear switchboard designed to control all services (and Floor-warming) for a Comprehensive School, Menai.

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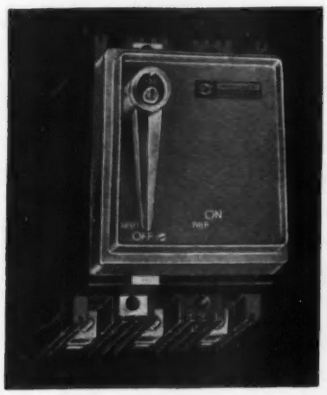

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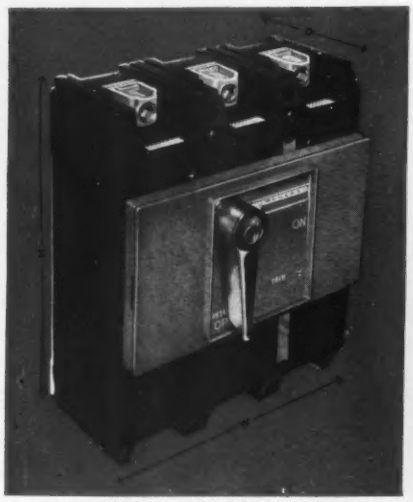
Ease of Assembly into MV Switchgear



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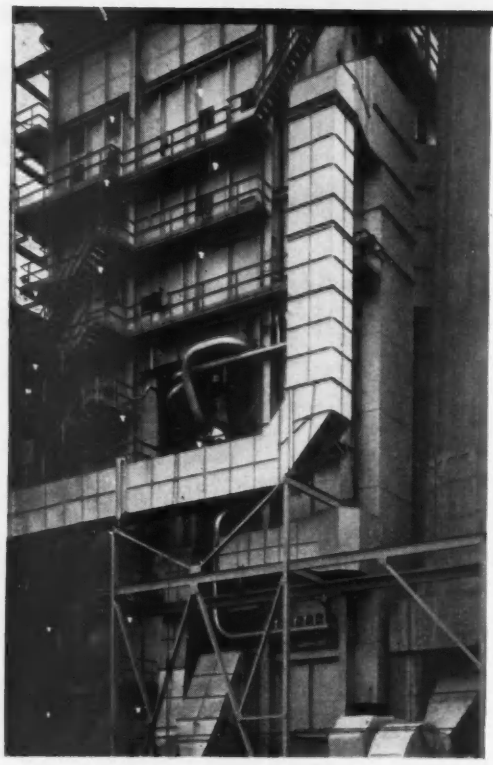

So said Mr. Richard Wood, the Minister of Power, at the inauguration of Britain's first once-through super-critical forced-circulation boiler. Designed and built by Simon-Carves at the Margam works of the Steel Company of Wales, it marks a major advance in large-scale steam generating practice.

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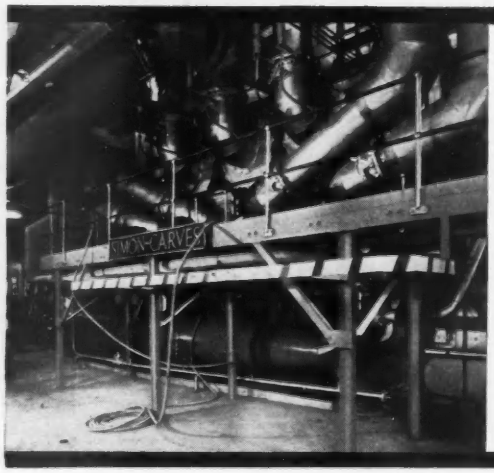

left. The operating front of the boiler is housed in the turbine building. Fuel can be blast furnace gas or fuel oil or a mixture of both.

right. The central control panel. From here, both the boiler and the high pressure turbines are controlled.

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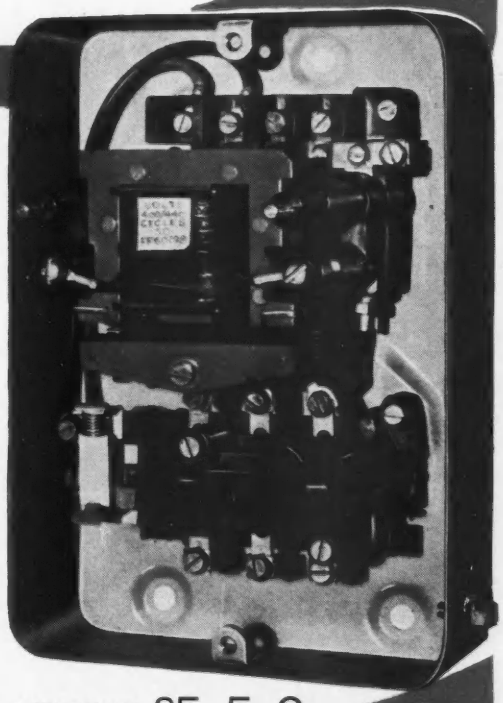

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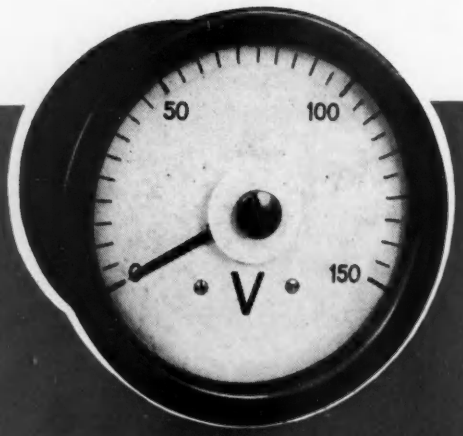

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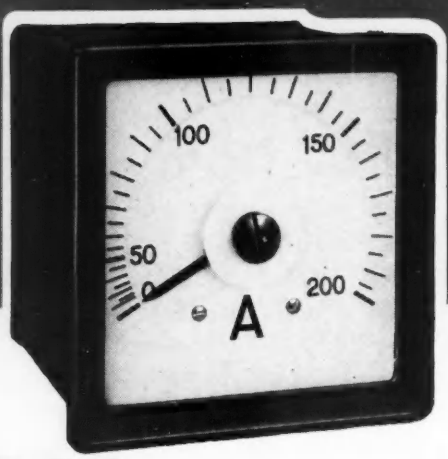

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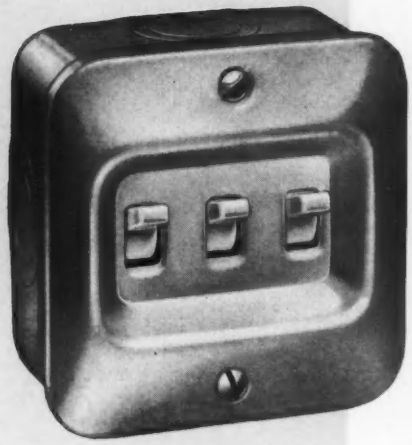

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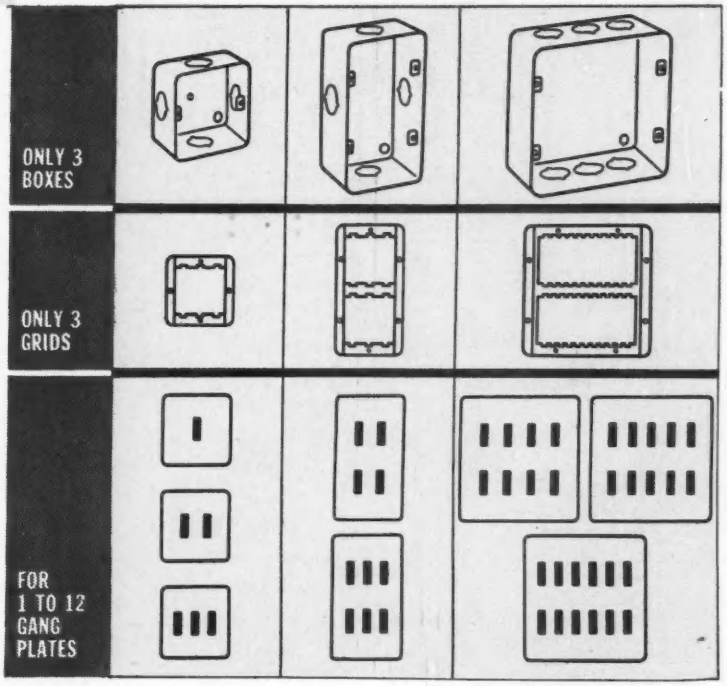

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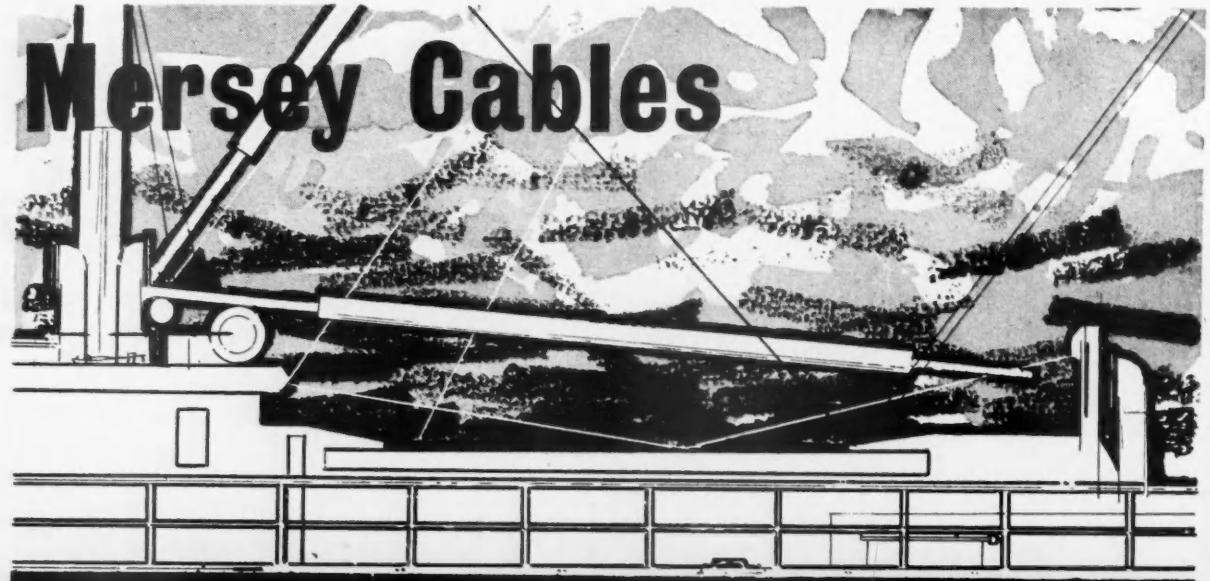

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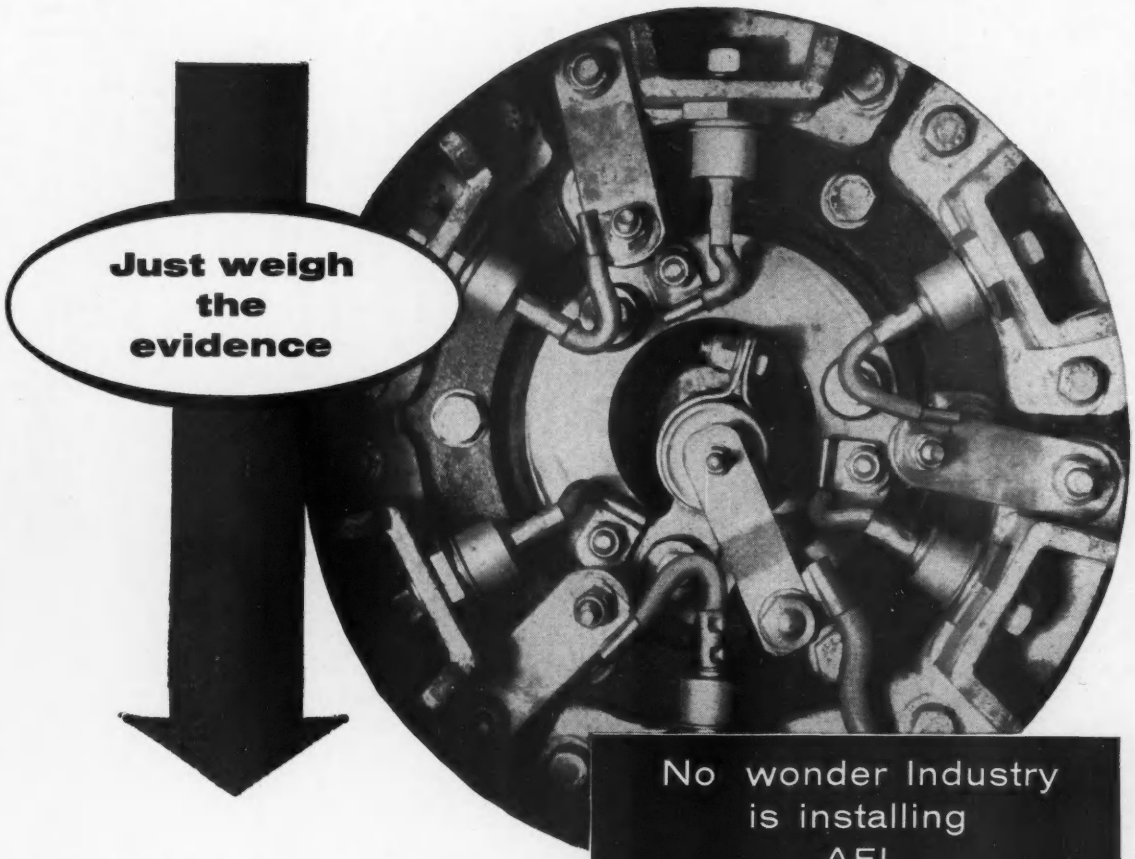

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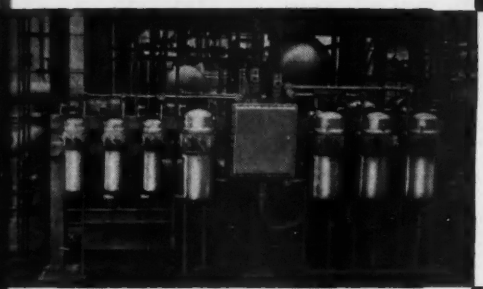
Square D Electrical Control Gear

UNITED KINGDOM

General view of an Asquith 18-station Transfer Line for machining automobile cylinder heads, both 4- and 6-cylinder types being handled on the same machine at Vauxhall Motors Ltd.

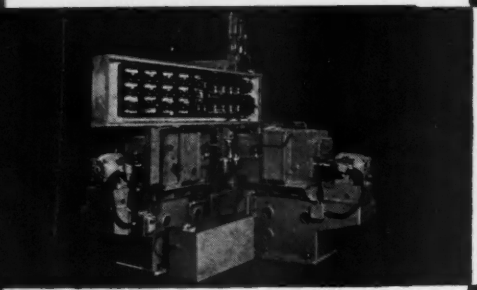


U.S.A.

A grouping of "Spin-Top" Flameproof Combination Starters at an American Oil Refinery.

BELGIUM

A regular delivery of Square D control gear is made throughout this country. This van and similar are a familiar sight around the world.



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W. GERMANY

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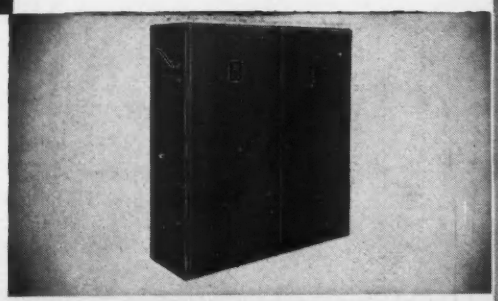

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BICC Capacitors effectively reduce crusher operating costs at the Asham Quarry Co. Ltd., Chantry, near Frome, Somerset. The electricity supply is taken from the Southern Electricity Board at 11 kv and the tariff incorporates a kVA maximum demand charge. The load was 465 kVA at 0.6 power factor, and the installation of 304 kVAr of BICC Capacitors has resulted in annual savings well in excess of the installed cost. If you use electrically operated machinery, our specialist engineers will be pleased to investigate your electrical system, without obligation, and advise the financial saving available to you by the use of BICC Biclor Capacitors.

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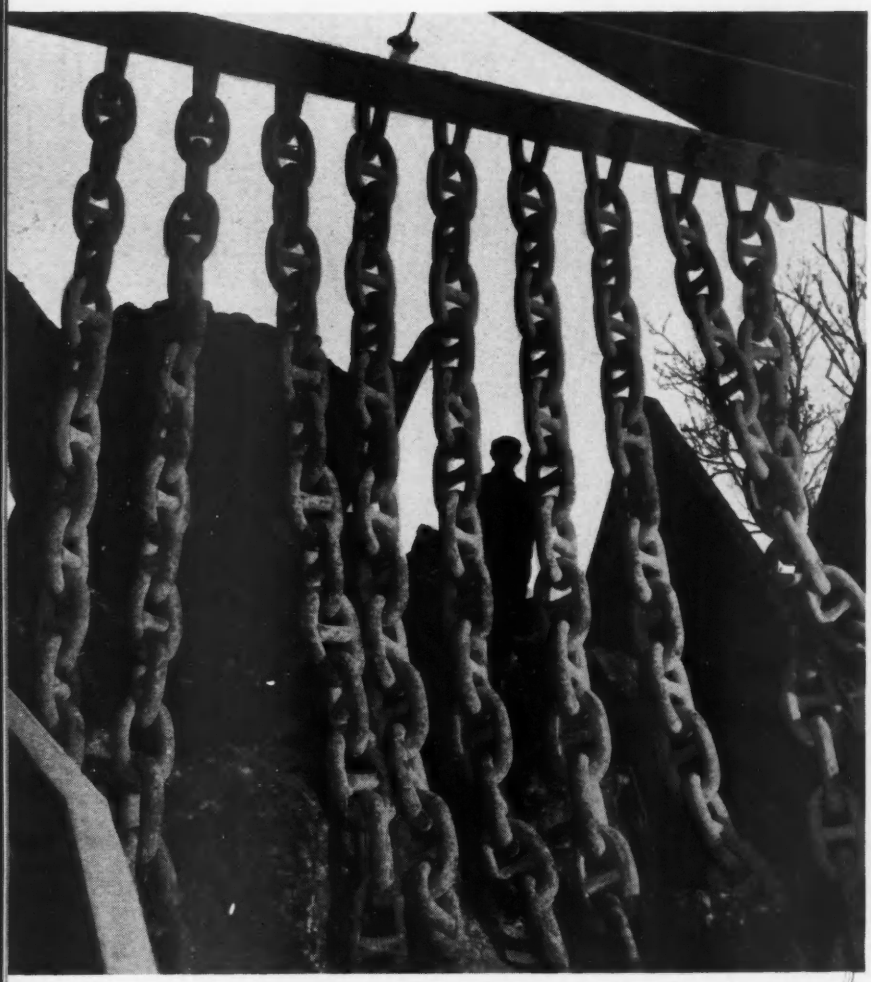
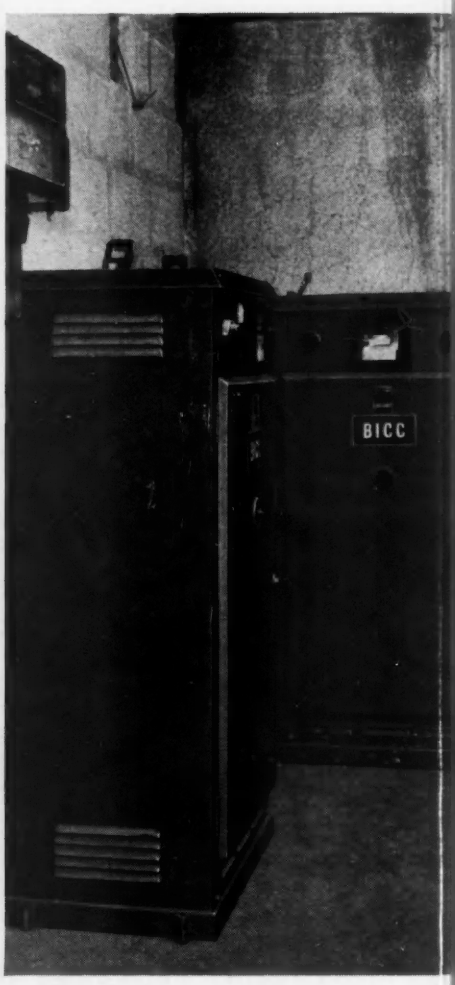


Primary crusher stone chute at the Asham Quarry Co Ltd



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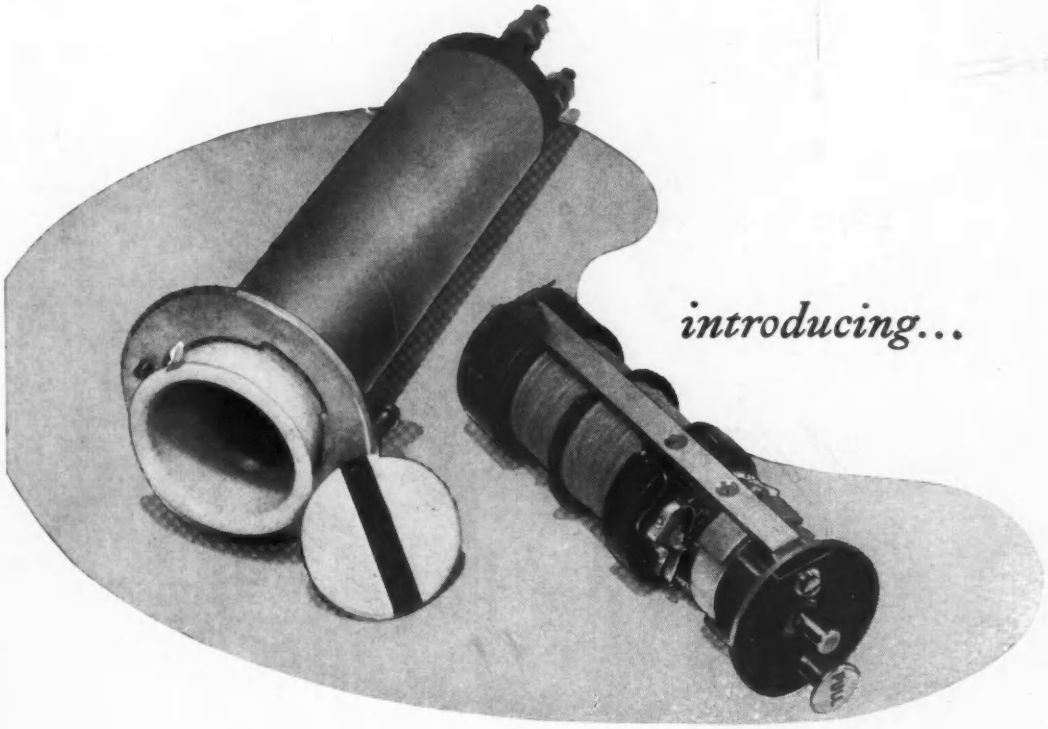

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HEATING AND WELDING DEPARTMENT TRANSFORMER DIVISION

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THURSDAY 13 APRIL, 1961
Registered as a Newspaper Volume 139 No. 15

ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

Copper and Aluminium in Electric Cables 583
by C. C. Barnes, M.I.E.E., M.A.I.E.E., A.B.I.M.

Telex Centre for G.P.O. 587

MVAr in Supply Planning 588

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SUBSCRIPTION RATES: United Kingdom £4, Overseas £4 10s per annum. Canada and USA $12 per annum. Subscriptions are payable in advance and may commence with any issue. Overseas subscriptions may be paid by banker's draft, cheque, international money order or credited to the Electrical Times Ltd., at Coutts and Co., 440 Strand, London WC2. Single copies price 1s 6d. Postage 6d.

Dans ce numéro

Cuivre et aluminium dans les cables électriques ... 583

Les ingénieurs ont très souvent à choisir pour les cables entre le cuivre et l'aluminium et leur choix doit tenir compte à la fois des facteurs techniques et du coût. L'adoption du cablage serré est un des développements importants qui ont eu lieu dans la conception des cables conducteurs. Les difficultés de jonction pour l'aluminium sont un élément important à considérer et quatre méthodes de soudure sont décrites ainsi que l'emploi des connecteurs du type à compression mécanique.

Fourniture de MVAr en Grande Bretagne 588

Quand la demande sur le réseau britannique atteint 30.000 MW, les générateurs intéressés rendent mieux s'ils fournissent 11.000 MVAr. On a trouvé souhaitable, en tenant compte des caractéristiques du système de transmission, d'avoir aux principales sous-stations un facteur de retard de phase de 0,93. Il est recommandé de prévoir une installation de compensation réglable permettant de maintenir ce facteur de charge en ces points. Des études économiques indiquent le coût de la fourniture de charges d'un facteur de puissance plus faible.

Nouveau code d'éclairage britannique 599

Dans le nouveau code de la Société de mécanique d'éclairage britannique (IES) pour l'éclairage intérieur les sources de lumière naturelles et artificielles sont considérées comme complémentaires pour déterminer l'éclairage total. Ceci entraine une nouvelle attitude quant à la conception de l'éclairage jour. En adoptant des niveaux d'éclairage plus élevés sur la surface de travail (en moyenne supérieurs de 50% aux précédents) on augmente le problème de l'éblouissement. Dans le code figure une méthode pour évaluer la gêne provoquée par l'éblouissement dans les installations d'éclairage courantes.

In dieser Nummer

Kupfer und Aluminium in elektrischen Kabeln ... 583

Ingenieure stehen oft vor der Wahl zwischen Kupfer und Aluminium als Kabelmaterial. Sowohl technische als auch Preisgründe müssen bei der Entscheidung eine Rolle spielen. Zu den bedeutsamen Entwicklungen in der Konstruktion von Kabelleitern gehört die "Kompakt"-Verseilung. Die beim Aluminium gegebenen Schwierigkeiten der Kabelverbindung spielen ebenfalls eine wichtige Rolle und es werden vier Lötmethoden beschrieben, sowie die Anwendung von Verbindungsstückn, die mit mechanischem Druck arbeiten.

MVAr-Elektrizitätsversorgung in England 588

Sobald die Anforderungen an das britische Elektrizitätsversorgungsnetz 30 000 MW erreicht haben, werden die hiervon betroffenen Generatoren optimal mit einer Blindleistung von 11 000 MVAr arbeiten. Wenn man die Besonderheiten des Übertragungssystems in Rechnung zieht, so stellt sich für die Hauptunterwerke eine Blindlast mit einem Leistungsfaktor von 0.93 bei nacheilendem Strom als empfehlenswert heraus. An diesen Punkten sollen auch regelbare Ausgleichsvorrichtungen zur Aufrechterhaltung dieses Leistungsfaktors eingesetzt werden. Wirtschaftliche Untersuchungen zeigen die Kosten der Stromversorgung bei Blindlasten mit kleinerem Leistungsfactor auf.

Neue britische Beleuchtungsvorschriften 599

In den neuen Vorschriften für Innenbeleuchtung der British Illumniating Engineering Society (IES) werden natürliche und künstliche Lichtquellen bei der Gesamteinschätzung der Beleuchtung als Faktoren aufgefasst, die sich gegenseitig ergänzen. Hinsichtlich der Vorkehrungen für Tageslichtbeleuchtung erfordert dies neue Ausgangspunkte. Der Umstand, dass die Beleuchtungsgrenzen für Arbeitsflächen (um durchschnittlich 50%) hinaufgesetzt wurden, erschwert die Lösung des Blendungsproblems. Die Vorschriften geben eine Methode zur Einschätzung der bei Beleuchtungsanlagen durch Blendung verursachten Störungen an.

REPEAT SET COMMISSIONED AT LYNTON NOVEMBER 1960

REMOTE CONTROL GAS TURBINE DRIVEN A C GENERATOR

FOR PEAK LOPPING AND EMERGENCY POWER

The S.W.E.B. has ordered a further set for delivery later this year.

COMMISSIONED AT PRINCETOWN DECEMBER 1959

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 13 APRIL, 1961

Editor and Managing Director:
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K. C. POUNDS, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E.

News Editor:
T. W. WRIGHT

Comment

GUIDE FOR GOOD LIGHTING

The importance of lighting in securing efficiency at work and a sense of well-being generally is widely acknowledged; but the interplay of conflicting factors is sufficiently complex to keep the design of lighting installations an art rather than a precise science. Yet it is an art with a wealth of scientific background, and since 1936, the recommendations of the Illuminating Engineering Society have brought together the relevant scientific information in a form readily usable by those concerned with lighting installation design. The latest in the series of IES codes was introduced on Tuesday, honoured appropriately by a meeting which was a Royal occasion, and its contents and form of presentation alike make it a notable advance on its predecessors. It recommends increased illumination levels, as was to be expected—the lowest general working value goes up from 6 to 15 lumens/sq ft—but beyond that, it presents a far more tightly integrated consideration of the twin problems of obtaining enough light to see the job to be done, and avoiding such a level of glare that discomfort is risked. Sufficient brightness in the object viewed is sought, to ensure that someone with normal eyesight suffers little diminution in efficiency of performing the task in hand, and for design convenience, that brightness is expressed as an illumination level. But a secondary calculation is called for, to check the degree of glare to be expected from the installation required to give the recommended illumination. If the glare is above the limit, the lighting engineer is enjoined to search for another way of giving the required amount of light. This technique the Code advocates persuasively; but it comes back to recognition that the art remains in lighting design; the preface warns against "too rigid" interpretation of the recommendations.

GENERATING REACTIVE POWER

It is becoming increasingly complex to arrange for the supply of kilovars demanded by consumers whose plant operates below unity power factor. The British power supply system, as it grows more efficient in fuel consumption and its use of capital plant, is becoming less tolerant of reactive power. Last week, IEE members had before them predictions of the situation when the maximum demand on the system reaches 30,000 MW a year or two hence. The largest, most efficient machines will deliver their full output only at unity power factor, while the longer, higher voltage transmission lines that will be in service will present troublesome excess capacitative load at times of light consumer demand. Both factors spell an urgent need for introducing into the system more compensating plant, effective at bulk supply points

and capable of generating either leading or lagging megavars. Whether synchronous condensers should be used, or static devices like capacitors with fast-acting transductors, is a complex problem in economics and technical prediction. Meanwhile, whatever type of compensation is decided on, there is support for the introduction of automatic control of reactive power generation, and close programming by system engineers of this element of supply. "Megavars generated by the exciter" is a concept likely to become familiar in the future, referring to operation to maintain a specified megavar/megawatt ratio from a generator, rather than specified megawatts and a constant voltage. All such changes mean more equipment, more spending, so the IEE members considered as well how tariffs could best reflect the new complexities of the cost of reactive power. No clear conclusion appeared, for this is a complex problem where technical and commercial considerations clash: but a case for revising the form of some m.d. tariffs seemed to be made out.

WIRING IN AUSTRALIA

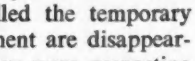
Australia has a wiring code with stronger legislative backing than the IEE Regulations have in Britain, but it is a code with the same basic principles: ensuring safety from fire and shock. A 1961 edition of the code has just been published in a handsomer, larger volume than the equivalent UK book, something over ten years after the fourth edition appeared. Inevitably, it has many similarities to the IEE Regulations, often masked by variations in wiring practice, but there are fundamental differences as well, as an article on a later page notes. The layout of the code seems better adapted than that of the IEE to be read and worked to by engineers and wiremen—though at the disadvantage of being more costly. In particular, the concentration on working back to clearly indicated definitions seems worth consideration here, as does the more generous indexing; and publication of an official guide to changes from the previous edition is a practice of undoubted value, which must do much to get the detail of the changed code more quickly observed. It is too early to judge the reaction to this Australian code of those who have to use it, but it looks a workmanlike document to British eyes—even though it sticks to a relatively unrestricted tree distribution system for the lower-rated socket-outlets, and imposes only minor restrictions on the installation of socket-outlets in bathrooms.

OFFICIAL TRADE PREDICTIONS

Trade outlook for the rest of 1961, as seen through the eyes of the Government's Civil Service advisers, is moderately bright. The economic survey, annual precursor of the Budget, highlights for the engineering and electrical goods industries an order book 20% more valuable at the end of 1960 than a twelve-month earlier—with the increase spread equally in home and export markets. Moreover, manufacturing firms who use the products of the heavier parts of the electrical industry are reported to be planning to spend about 30% more this year than last; and private building is predicted to rise, with all that means for installation materials and appliances. But though these figures may be encouraging, they do not guarantee a clear way ahead for industry. Apart from what next Monday's Budget may bring in new financial factors, there is the broader interplay of world trade to bear in mind. Throughout the economic survey runs a note of unhappiness about exports; and this is likely to be echoed in the electrical field, despite the industry's comparative success. More streamlining to meet the demands of potential overseas customers seems necessary, with a new design initiative that can also relieve the pressure to import. Moreover, the electrical industry is still working out the effect on its trading practices of the dual influences of merging manufacturers and the RTP Act; both initially manifest themselves in price and production upsets. This year cannot fail to be a testing time for electrical manufacturers. Any help they receive from favourable circumstances in general trading conditions will be particularly valuable.

REGIONAL TIDINESS

When the present regional structure of the Central Electricity Generating Board was established, it seemed probable that further erosion of divisional functions was envisaged. Generation construction was immediately lost; now, in a further evolutionary move, transmission construction is passing out of the hands of divisions. Concurrently, the awkward multiple names that have signalled the temporary nature of the prevailing arrangement are disappearing, since the divisional titles they were respecting are being changed in many cases, in recognition of their new status as divisions of regions, rather than divisions of the CEGB. In the process, London Division is disappearing altogether, to be replaced by North and South of the Thames operating authorities under South Eastern Region. As a result of the changes, divisions will be concerned only with the day-to-day operation and maintenance of stations and lines within their boundaries, and it will be some time before all the consequential changes are complete. Whether this is the final arrangement is uncertain. The North Western Region (as it becomes) is apparently to continue to operate without the interposing of anything akin to divisional control between the regional staff and power station superintendents and transmission district electrical engineers. This might be taken as an endorsement of the success of the extreme of regionalisation to which that organisation was experimentally committed in 1954. However, there are arguments in the contrary sense, which might be held to justify more strongly now than a few years back, the retention of the further tier of management that the division represents.



This week's quick summary of electrical news faces advertisement page 16

Copper and aluminium in electric cables

by C. C. Barnes,* M.I.E.E., M.A.I.E.E., A.B.I.M.

PART 1

COPPER and aluminium are vigorous contenders for the market offered by cable making. It is the purpose of this article to review the economic and technical factors which have to be taken into account in choosing between them, not only as conductors but also in other electric cable applications.

Copper[1,2,3] has been used in the service of man since about 4500 B.C. It was not, however, until the birth of the electrical industry at the beginning of the nineteenth-century that copper was used to any great extent. The annual world production about 150 years ago was of the order of 18,000 tons per annum, and today world production is about 4,000,000 tons per annum.

Each year the British electrical engineering industry uses approximately 300,000 tons of copper, most of it in the form of high conductivity copper wire, sheet, strip, rod and sections. The greater proportion of the vast quantity of copper used for electrical conductors is fabricated into wire for the production of insulated electric cables. The majority of power cables employ copper for the conductor because of its good conductivity, easy working, simple jointing and, until recently, its economic advantage. Copper has always been the electrical designers' basic conductor material. Only silver has a higher conductivity (see Table 1), but its general use as a conductor is naturally precluded by economic considerations.

Table 1. Relative Electrical Conductivity of Various Metals

Metal	*Relative Electrical Conductivity (Copper=100)*
Silver	106
Copper	100
Aluminium	62
Zinc	29
Tin	15
Lead	8

On the other hand, metals of low conductivity could be utilised if an increase in the overall dimensions of cables (or other electrical equipment concerned) were acceptable.

Aluminium[4,5,6] was used to a limited extent in the early electrical engineering developments, and it is only in recent years that the use of aluminium as a conductor material for general use in all types of electrical equipment has begun. In 1900, about 7,000 tons of aluminium was produced. Until 1956 the growth in production continued, the free world totals in short tons in recent years being:

1952	...	...	1,953,800 tons
1953	...	...	2,353,300 tons
1954	...	...	2,638,900 tons
1955	...	...	2,856,600 tons
1956	...	...	3,080,400 tons

followed then by a slight setback to 3,050,400 tons.

* Mr Barnes is with the CEGB.

Economic Considerations

The price differential between copper and aluminium ingot narrowed very markedly in the immediate post-war period, until in 1945-46 copper for the first time cost more per ton than aluminium. The considerable rise in the price of copper in the early months of 1956 created conditions which necessitated a review of the use of aluminium in the electrical industry and a marked increase of interest in aluminium conductors followed.

By contrast, copper prices on the London market in February, 1958, fell to £160 10s, the lowest level since the war, and the turning point in the price decline from the abnormal level of £437 in March, 1956.

Unfortunately, copper price variations continued, and Fig. 1 shows how the price moved upwards during the three months' period August—October, 1959, after USA copper workers walked out on strike in August, 1959, and the added effect on the price when the Chileans joined the strike on 2 October will also be observed. Fig. 2 gives an indication of metal price variations over the years 1957—1960. It also shows the relatively stable price level of

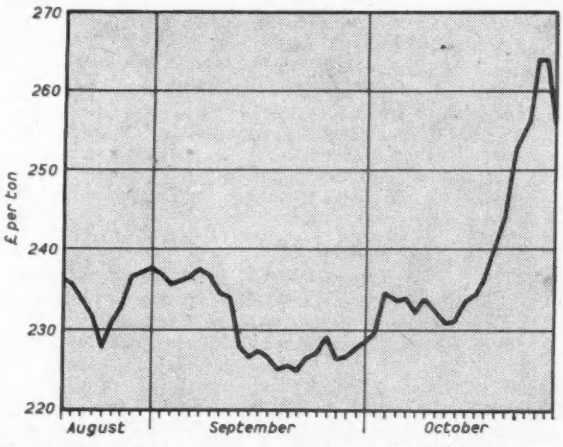


Fig. 1. Variation in price of copper over three months in 1959. Note false zero

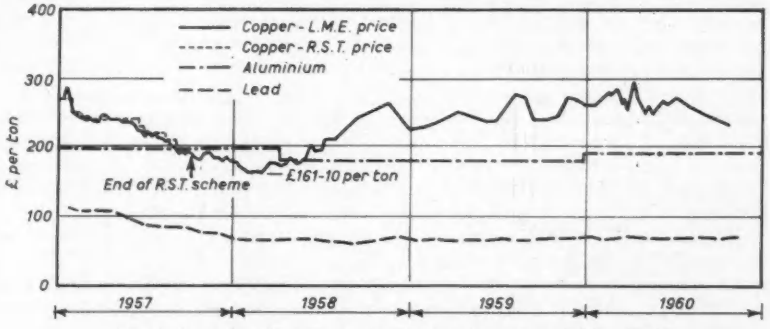


Fig. 2. Variation of copper, lead and aluminium prices, 1957 to 1960

aluminium. Fig. 3 (due to Parish[7]) shows the increase in world production of copper and aluminium over the 17 years from 1938 to 1955. The average annual increase in the production of copper was about 3% and of aluminium about 10% until in 1955 the output of both metals is of the same order.

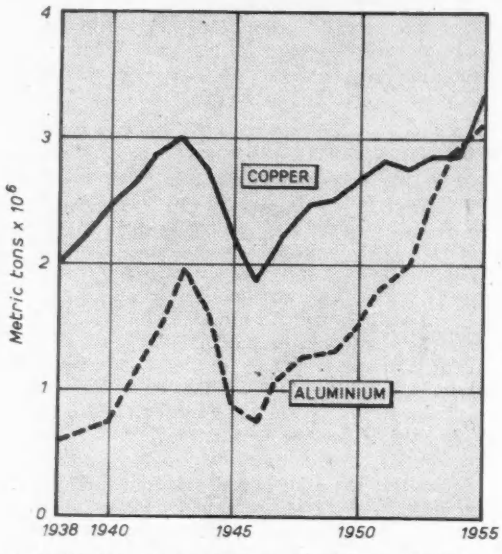


Fig. 3. World production of primary aluminium and copper

It is clear that the copper market has been, and will doubtless continue to be, very sensitive to changes in world demand which are closely related to political and defence considerations.

The following extracts from observations[8] by Sir Ronald L. Prain are of interest:

"Historically, the growth of world copper consumption from 1880 to the end of World War I averaged between 5% and 6% per annum then slowed down to under 2% per annum in the inter-war era.

"Since 1946 the growth has averaged nearly 4% per annum . . . the result of (these) studies shows that the demand for primary copper might increase from about 3,500,000 tons in 1960 to about 5,000,000 tons in 1970 . . . we may expect an annual increase in annual demand for primary copper between 1960 and 1970 of over 1,500,000 tons providing there is no abnormal increase in substitution by other metals . . . very little substitution occurs below and up to the price of £250 per ton (i.e., 31¼ cents per lb). . . ."

Table 2 (due to J. C. Bailey[9]) records the properties of copper, commercially refined lead and 99·5% aluminium as used for cable sheathing and electrical purity aluminium as used for conductors. It will be seen that there is a significant difference in the density, weight per cu ft, resistivity and in ultimate tensile strength. An aluminium conductor has greater bulk than a copper conductor of the same resistance, but it has a considerably lower weight. An aluminium sheath is considerably stronger than a lead sheath, both in tensile strength and fatigue resistance, as well as being several times lighter.

Significant factors for a comparison between copper and aluminium when used as conductors have also been summarised by Bailey,[9] as shown in Table 3.

Table 3. Comparison of Aluminium and Copper Conductors

	Aluminium : Copper
For Equal Resistance	
Area Ratio	1·61 : 1
Diameter Ratio (round conductors)	1·27 : 1
Weight Ratio	0·48 : 1
For Equal Current and Temperature Rise	
Area Ratio	1·39 : 1
Diameter Ratio	1·18 : 1
Weight Ratio	0·42 : 1
For Equal Diameter	
Resistance Ratio	1·61 : 1
Current carrying capacity	0·78 : 1

Copper—Origin and Processing[2]

Copper is mainly derived from ores of the cuprous sulphide (Cu_2S) type, the principal sources being the United States, Canada, Northern Rhodesia and the Belgian Congo. The metal is normally smelted near the mining site and frequently refined there also, generally by an electrolytic process. Some blister (crude) copper slabs are, however, imported into this country.

High conductivity electrolytic copper is imported from the sources quoted in bar form, each weighing from 250 lb to 275 lb. These "wire bars" are usually heated in an oil-fired billet furnace and hot rolled into rods, the rod size normally used by cable makers being of ½ in. diameter. The heated bar is raised to a temperature of approximately 1,650°F and automatically discharged from the furnace between guides. It is directed on to live rolls that convey it to the first pass of the roughing rolls, which are provided with three rollers, one above the other, enabling the heated rod to be passed backwards and forwards.

The bar is thus progressively reduced in section and increased in length, being repeatedly rolled automatically after the first pass till it reaches a suitable cross-section for transfer to the intermediate rolls and finally to the finishing rolls, whence it is fed to coilers which wind it into 3 ft diameter coils.

Apart from dimensions, there is a very important difference between copper rod and wire. The rod is rolled by a hot process, whereas the wire is cold-drawn, and the hot rolling already described renders the physical characteristics of the metal suitable for the subsequent wire-drawing operations.

The ½ in. diameter rods are received at the cable factory with a surface coating of copper oxide, resulting from the previous hot rolling operation. This coating is removed by "pickling" the rods in a bath of dilute sulphuric acid for a period; then they are washed in water and finally dipped in an alkaline bath to neutralise any traces of acid still present. The rod is then electrically butt-welded and fed continuously into wire-drawing machines.

Table 2. Properties of Metals Used in Cables and Conductors

	Copper—High Conductivity Annealed	Lead—Commercial Refined	Al 99·5%—Hot Extruded Tube	Al 99·5%—After Sinking	Al 99·5%—Hard Drawn Wire	Al 99·5%—¾H Wire	Al 99·5%—Annealed Wire	Al—0·5% Mg—0·5% Si Specially Heat Treated
Density at 20°C (gm/cu cm)	8·89	11·37	2·703	2·703	2·703	2·703	2·703	2·70
Weight/cu ft (lb)	555	710	169	169	169	169	169	169
Coefficient of Linear Expansion/°C × 10⁶	17	29	23	23	23	23	23	23
Melting Point (°C)	1,083	327	659	659	659	659	659	580—660
Specific Heat (cal./gm.)	0·092	0·031	0·23	0·23	0·23	0·23	0·23	0·23
Thermal Conductivity (cal./cm/sec/°C)	0·92	0·082	0·54	0·54	0·54	0·54	0·54	0·48
Resistivity at 20°C (microhm-cm)	1·724	20·65	2·84	2·84	2·8264	2·8264	2·80	3·22
Temperature Coefficient of Resistance at 20°C	0·0039	0·0042	0·004	0·004	0·004	0·004	0·004	0·0036
Ultimate Tensile Stress (tons/sq in.)	15—16	0·7	4·5—5·5	5·5—7·5	10—12	7—10	4·5—6·5	19·4
Fatigue Endurance Limit (tons/sq in.) (10^7 reversals or where marked,* 5×10^8)	±4·5 approx.	±0·18 approx.	±2·5 approx.	±2·8 approx.	±2·8* approx.	±3·8* approx.	±2·2* approx.	—

Wire-drawing

"Drawing" the rod consists of pulling it through a series of dies, the surfaces of which are gradually reduced in diameter. Tungsten carbide (or steel alloy) dies are used for large diameter wires and commercial diamond dies for fine wires. The former are made accurately to predetermined contours and are used in a highly polished condition. When worn, so that they yield a product that is outside the permissible tolerance, they are opened out to the next size and repolished.

The simplest type of wire-drawing equipment, known as single-hole or bull-block machines, consists essentially of four parts: a framework known as the "swift" that rotates freely on a vertical spindle and on which is placed the coil of wire to be drawn down, the die and its holder, the electrically driven block (shaped like a drum around which the drawn wire is coiled) and mechanism for pulling the leading end through the die, for attachment to the block. Wire down to ¼ in. diameter is usually drawn on bull-block machines.

Modern wire-drawing machines are of the "continuous type" by which up to 20 passes, or reductions of diameter, may be made in one operation. With nine or 11 die machines, ¼ in. diameter rod can be drawn down to 0·052/0·044 in. diameter wire in one operation, a 440 yd length of rod becoming approximately 10,200 yd of 0·052 in. diameter wire, or 14,200 yd of 0·044 in. diameter wire.

The drawing of copper produces a hard drawn wire which is suitable for overhead power lines but is not satisfactory for the insulated cores of power cables. Therefore, the hard drawn wire is subjected to an annealing process in order to restore the ductility, elongation and electrical conductivity necessary for power cable work.

In one modern type of annealing furnace the coils of copper wire are placed in vertical cylinders and covered with a water-sealed bell. Over the latter is placed a further cover containing electrical elements to heat the wire to 400°C to 550°C, according to the dimensions and quantity of wire in the container.

It takes about 1¼ hr to reach the required temperature: then, following the removal of the heated cover, the wire is allowed to cool naturally for six to eight hours, after which water is sprayed on to the surface of the under-bell. An interval of one to two hours is necessary for the wire to cool down to normal atmospheric temperature. Throughout the whole annealing process the coils of copper wire are maintained in an atmosphere of nitrogen containing a slight trace of hydrogen.

British Standard annealed copper wire is in the softest practicable condition and BS 128 ("Bare annealed copper wire for electrical machinery and apparatus") contains the following clause.

When a sample wire 10 in. long is slowly and steadily stretched, the elongation without fracture shall be not less than the appropriate values given below:

Size	*% Elongation*
0·0076 in. diameter and under	15
Above 0·0076 in. to 0·020 in. diameter	20
Above 0·020 in. to 0·048 in. diameter	25
Above 0·048 in. diameter	30

The routine control testing of copper wire in the cable factory normally comprises visual examination and measurement of resistance, dimensions and tensile characteristics.

Stranded Conductors

After the required amount of wire has been wound on to steel bobbins, depending on the wire diameter and size of bobbin, the bobbins are loaded into the stranding machine which twists the individual wires into strand formation, alternate layers of wire being applied in reverse directions to ensure that a good circular strand is produced and to prevent "bird-caging" when the strand is bent.

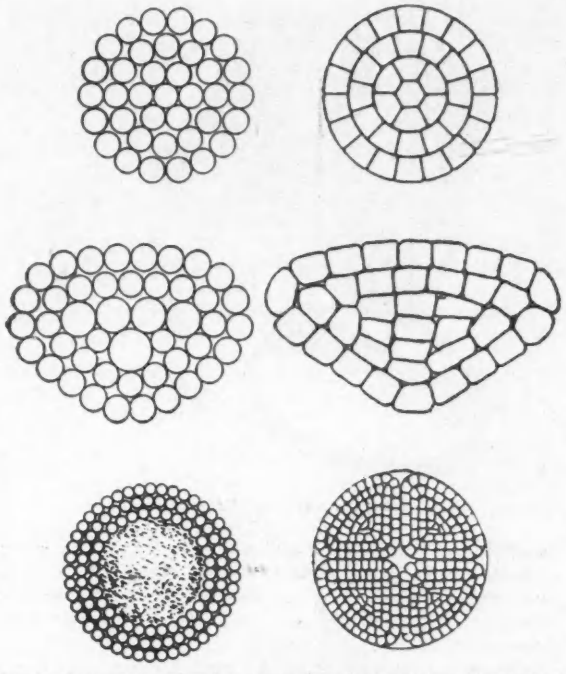


Fig. 4. Cross-section of various types of conductor, contrasting compact designs (right) with conventional stranding (left)

For multicore cables, a non-circular section is preferred. The cross-sections of various types of copper conductors which have been adopted by the cable industry are shown in Fig. 4. The "compact" type of stranding is widely used in America and is now being introduced into this country.

BS 480:1954 specifies that the standard resistance of shaped conductors shall comply with the values given in Table 6 of that British Standard. Furthermore, in the formation of shaped conductors containing less than 19 wires, the same number of wires are required to be used as for a circular conductor of equivalent area. For conductors having 19 wires or more, BS 480:1954 states that the number of wires shall be the same as in a circular conductor of equivalent area, subject to a maximum permissible variation of plus or minus one wire. All the wires in any given shape of conductor have to be of the same nominal area. These requirements have prevented the use of a more compact conductor having improved space factor and they are likely to be revised in the near future to provide scope for this greater efficiency in design and consequent economy. Consideration is now being given to the possibility of field experience being obtained with copper conductors having an improved space factor.

With e.h.v. cables, a smooth conductor surface contributes towards improved impulse performance and this has been achieved either by dieing down or rolling and then screening with carbon black or, alternatively, metallised paper tapes. This practice has followed the introduction of shaped conductors for gas-filled and oil-filled cable operating at 33 kV, and is established practice for circular conductors in the higher voltage cables.

Without this practice the corrugated surface of stranded conductors produces peaks of stress around the periphery which may be 10% to 25% higher than the stress calculated on the assumption of a smooth cylindrical surface

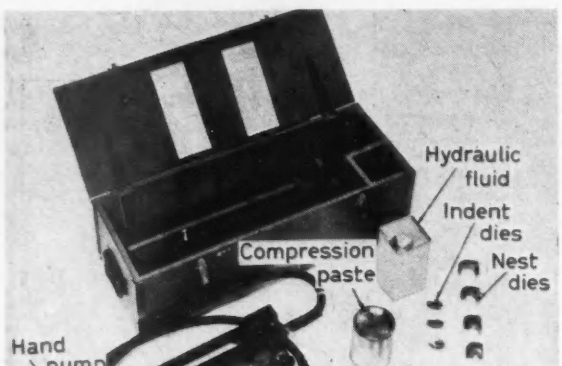


Fig. 5. Set of compression jointing tools by BICC

which is the customary practice. This variation in stress around the periphery also produces tangential stresses, thus tending further to reduce the inherent dielectric strength by comparison with that given by the same insulation thickness on a smooth surface.

Hollow copper conductors as used for single-core oil-filled cables are compacted by making the strand from preformed wires and then drawing the completed strand through a die. Compacting of shaped conductors is, of course, achieved by rolling.

Insulated Aluminium and Copper Conductors

Except for certain special applications which favour aluminium technically, copper is the preferred material for insulated conductors. None the less, aluminium is by far the most suitable alternative to copper although, as indicated earlier, its adoption or otherwise is largely governed by the price of copper. In some cases, for example in Germany, non-availability of copper has been the major consideration and this has constrained some large authorities to become permanent users of aluminium.

Aluminium suffers a disadvantage in imposing larger-sized conductors than for copper for a given conductivity and thermal rating, and this in turn increases the volume of other component materials in the cable. Against this it has considerable advantage in weight, and with the establishment of satisfactory, albeit somewhat more complex, jointing techniques during the past decade, its use now presents little greater difficulty.

Some indication of the modern usage of aluminium conductors is given by the following extracts:

London Electricity Board Annual Report, 1958-59.—The use of cables with aluminium cores for new h.v. trunk feeders was reintroduced in consequence of a rise in the price of copper. All standard l.v. and m.v. cables having cores of greater cross-sectional area than 0·10 sq in. were purchased with aluminium cores; *and later:*

Improvement has been made and more experience gained in the jointing of aluminium conductors and experiments in the use of gas blow torches and furnaces have shown promising results in increased efficiency and economy by comparison with the traditional method of using paraffin blow lamps and coke braziers.

South Western Electricity Board Annual Report, 1958-59.—The Board of Trade Machinery Price Index (1954=100) rose by 2·3% during the year from 113·7 to 116·3. This advance largely reflected the higher market cost of copper which on 1 April, 1958, was £179 per ton, and on 31 March, 1959, was £249 per ton (with variations during the year between £173 and £261 per ton). Variation in the price of copper supports the view expressed last year that it is necessary to keep the economics of the use of either copper or aluminium conductors under continuous review. Considerable quantities of aluminium conductors have again been used during the year.

The jointing of copper conductors is well established and requires no special comment, but a matter of considerable interest when considering the use of aluminium conductors (or sheaths) is the technique of jointing to be adopted.

The most vital considerations in making a joint in cable conductors is that it should have permanently high electrical conductivity and good mechanical strength. For the ideal soldered joint in stranded conductors the joint area is a solid mass of solder and strand with no voids. Practically, however, this is seldom achieved, even with copper, which is a relatively easy metal to solder.

Five methods of jointing aluminium conductors are referred to below:

1. The solder basting technique employing TCZ* solder and "ALGLO" or "Kynal" fluxes[10] (a technique recommended by the CMA).
2. Flame heating method
3. Resistance heating method
4. Solder basting method

(Using reaction flux techniques.)

5. Compression jointing.

Method 1, which is well established, has now been modified by introducing a cadmium-free solder, as follows, to eliminate toxic fumes from that source.

Cadmium-free Solders

	Fry's Alca P	*Grey and Marten's GM4*	*ICI Kynal S35*
Lead ...	52	53·3	15
Tin ...	45·5	44·5	77·5
Zinc ...	2·5	2·2	7·5

There are also prospects of improving the flux from the fuming point of view.

A characteristic feature is the end preparation of the stranded conductor, in which the successive layers of wire are cut back and fanned out in order to facilitate the penetration of the solder and to ensure that the ends of all the wires are securely embedded in the solder.

The basic features of the flame heating technique are:

(a) Joint assembly heating is effected by means of a propane gas torch.

(b) End preparation of the strand is not required.

(c) The use of a solid-type ferrule is desirable but not essential.

(d) Cold solder is fed directly into the ferrule and is held within the assembly by means of heat-resistant tapes.

Since flux residues and charred compound cannot be washed away, precautions are essential to avoid trapping these residues.

(e) Cambric tapes are employed with this process instead of the oil impregnated tapes generally used with the solder basting method.

The resistance heating technique utilises heavy electric currents in place of a naked flame for heating the joint assembly (a current of the order of 500 A and a very low voltage is used).

Solder basting technique employing a reaction flux has an advantage in that the jointing procedure is almost identical with that used for copper conductors. The essen-

* The composition of the TCZ solder, also known as "ALGLO" and "ALCOA" 803 metal, is as follows: Lead, 52%; Cadmium, 9%; Tin, 31%; Zinc, 8%.

tial feature of this process is that it uses a reaction flux in paste form, which is smoothed on to the stranded conductor prior to the application of the joint ferrule. At the first indication of flux reaction, solder is poured into and over the joint assembly until reaction is completed. Thereafter the basting operation is continued until the solder cools to a plastic condition. The joint can be wiped to a smooth finish in the normal way.

The jointing of both copper and aluminium conductors by means of compression type conductors has long been proved the most economic, efficient and reliable method for overhead conductors. It now appears to be generally acknowledged that properly designed compression joints can provide permanent low-resistance connections which are stable under all loading conditions. Compression jointing has an advantage that by using well designed tools[11] (Fig. 5) and connectors, uniformity of joint characteristics can be maintained, while minimising the dependence on the quality of workmanship during installation.

(To be continued)

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Telex centre for G.P.O.

FLEET BUILDING OPENED

THE largest Post Office building erected since the second world war was opened last Tuesday in the City. Fleet Building in Farringdon Street will house the automatic Telex switching exchanges giving access, not only to the United Kingdom, but also to the Continent and certain other places overseas. In addition, the building will eventually accommodate the Fleet Street telephone exchange and a further exchange if required.

Fleet Building was planned and constructed under the supervision of the Ministry of Works whose senior architect, W. S. Frost, was responsible for the design. The building has 15 floors with the lower six designed to take heavy post office equipment and the top nine floors for office accommodation. The staff will eventually be about 3,000 and the building includes a dining room with full facilities for providing 1,100 meals a day, two conference rooms and an assembly hall.

Design of the building was governed by a module dimension of 11 ft 5¼ in. to suit construction of the standard Post Office equipment to be installed. To meet town planning requirements, the two wings have been restricted to a height of 80 ft but the tower rises to 165 ft.

The building electrical system is designed for a total loading of 3 MW. The incoming supply is taken to two substations at 11 kV where it is transformed for distribution in the building at 440 V. Each floor is served by a rising busbar system with an average rating of 100 A, the service being split between the east and west wings. Distribution on the floors is by underfloor ducting, notable for its shallowness and being divided to accommodate both the ordinary distribution cables and those for the Post Office equipment.

One of the problems encountered by the electrical contractors was to provide a lighting system sufficiently flexible to be effective with changes in room layout. The system used extensively consists of fluorescent fittings attached to continuous lines of trunking. The fittings are attached by turnbuckles, permitting rapid and economical changes in layout. In the dining-room and assembly hall, specially designed fittings are installed, including modular ceiling fittings. The assembly hall also has a stage equipped with stage lighting and facilities for film projection.

Fleet Building, the new h.q. for GPO Telex services in the City, has 15 floors and rises to a height of 165 ft at the tower. The building has a gross floor area of 397,370 sq ft and about 5,000 electrical points were required to meet the installed loading of 3 MW

To provide emergency lighting in all apparatus rooms, the assembly hall and certain other locations, a 1·5 MW standby emergency diesel generating set is installed. The building has about 5,000 electrical points of which 3,700 are for lighting. The cost per point for the electrical installation was about £14 on average.

The building is served by six lifts with top speeds of 500 ft/min. These lifts are arranged in two groups of three with automatic programming control for each group. The building is heated by oil-fired boilers and forced ventilation is provided through filters for the lower five operational floors. In the basement, where cleanliness is essential, the filters are electrostatic.

MVAr in supply planning

BRITISH SYSTEM PLANS SUGGEST NEED FOR 0·93 P.F. AT BULK SUPPLY POINTS. TARIFFS SHOULD MATCH

ELECTRICITY consumers usually impose on supply authorities' loads at lagging power factors. How the necessary reactive power is to be supplied economically, and charged for in a manner equitable between one consumer and another, is a live problem at present. The various considerations that apply were discussed at a meeting of the IEE last Thursday, when a paper* was presented by Messrs W. Casson, M.I.E.E. (CEGB) and H. J. Sheppard, B.SC., M.I.E.E. (YEB).

Background to the situation is the differing capabilities of generators for supplying reactive power, and the effect of the growing transmission system. At present, generators can, on average, supply 0·7 MVAr/MW; that is, operate at a power factor of about 0·82. Large sets now coming into use, however, are designed for operation at unity power factor at full power, and have relatively little capacity for generating reactive power with full output. At the same time, system capacitance is increasing as longer lines at higher voltages are brought into use.

Automatic MVAr Control

In the paper, the question of reactive power is discussed first from the technical aspects of generation, transmission and distribution system design, and then from the standpoint of getting the consumer to pay for the cost above that of supplying power at unity power factor. At present, there is no automatic control of reactive power supply on the British grid.

The authors feel that many advantages would follow from its provision. Under present arrangements, the system control engineer has to adjust the reactive power outputs of generators when sudden changes in active power loading occur with generators under a.v.r. control.

Basis of provision of automatic control of reactive power generation might be advance planning of hour-by-hour optimum reactive power outputs for generators, in relation to their operation in merit order. The programme would include the appropriate tap changes on generator transformers. Voltage regulator settings would be adjusted in accordance with this programme, to fix reactive power output at the programmed levels, the voltage at the generator being allowed to change to maintain a constant MW/MVAr ratio.

Introducing the paper at the meeting, Mr Casson called this concept "reactive power generation by the exciter," and said it could be of great assistance to the system control engineer.

Such an arrangement would require some adjustable source of reactive power to provide the difference between programmed generation of lagging MW and that demanded by the load at any time. This source might take the form of synchronous capacitors, unloaded generators or equivalent devices connected at appropriate points on the grid system. These devices would be set to give the desired voltage at the points in the system where they were connected, and then left under control of automatic voltage regulators to absorb or generate lagging reactive power as determined by system demand.

The authors calculate likely system requirements when the maximum demand on the British system reaches 30,000 MW. At peak load, 30,000 MW, generators can be estimated as capable of producing 11,000 MVAr lagging at optimum conditions, while the balance of transmission system capacitance and inductance would give effectively 200 MVA of compensation. If the load were imposed at 0·93 p.f. lagging, it would involve the supply of 11,900 MVAr, so that only an extra 700 MVAr of compensation would be required—although considerably more would be necessary to cover all possible contingencies, including loading at a lower power factor.

"Optimum conditions" for generators, in the sense mentioned above, involves unity p.f. operation for those connected to the 275 kV system (8,000 MW at full load), and 0·9 p.f. operation for those connected to the 132 kV system (9,000 MW at full load). There would be 13,000 MW of generation at distribution voltages, also at 0·9 p.f.

For 20% of maximum demand as annual minimum, say 6,000 MW, all generated in sets connected to the 275 kV system, the reactive power demand at 0·93 p.f. would actually be less than the optimum generation, and lagging power factor loads (i.e., sources of leading reactive power) would be required as compensation. The estimate is, that the synchronous compensators would in fact have to offer control over the range 3,500 MVAr lagging generation to 2,500 MVAr leading, to cover all contingencies.

Compensation Techniques

If this scheme of providing automatic control of compensation is further investigated, it becomes necessary to consider the type of compensating device that should be used. The authors consider many possibilities, of which the most significant are the following:

Shunt capacitor.—This has the advantage of being static. Over a wide range of ratings, the cost is £2/kVAr to £3/kVAr, and losses are at the low value of 3 W/kVAr.

Synchronous compensator.—This has advantages of flexibility, and it can regulate voltage at the point of connection over a wide range. Cost is about £4/kVAr installed for a large unit, and losses about 20 W/kVAr to 25 W/kVAr. Disadvantages are that it can supply fault current to a system, and may introduce problems of instability. Unloaded generators can be used as synchronous compensators.

Synchronous motor.—Used as a substitute for an induction motor, it can rarely have an economical reactive power rating more than 30% of the active power.

* Paper No. 3528: "Technical and Economic Aspects of the Supply of Reactive Power in England and Wales."

Shunt capacitor combined with shunt transductor.—This gives variable reactive power generation or consumption with the advantages of static equipment. Accurate costs are said by the authors to be not readily available.

Series capacitor.—Primarily used to reduce voltage drop. Cost much the same as a shunt capacitor. The protective devices installed on series capacitors may make them ineffective under fault conditions.

Cost of Reactive Power

In the light of these possibilities and costs, the authors present calculations of the costs of supplying reactive power. They point out that there is some difficulty in estimating generation costs if the power factor is away from the 0·93 maximum. If spare generating capacity is available, the cost may be only that of the losses. On the other hand, it may be the full cost of special equipment. On the whole, they place the annual cost as between £0·1/kVAr and £1·0/kVAr. However, the cost in practice is small enough to be neglected in overall studies, compared with the costs imposed by the increased transmission and distribution circuit needs (including transformers). Power factor at bulk supply points at present lies between 0·85 lagging and unity.

For a hypothetical system ranging from 132 kV station switchgear to 415 V supplies, Fig. 1 shows the effect of demand for reactive power in increasing annual cost. Table 1 (next page) averages these figures. Voltage regulation as well as thermal limits are taken into account. It is with this background that the discussion of tariffs is embarked upon.

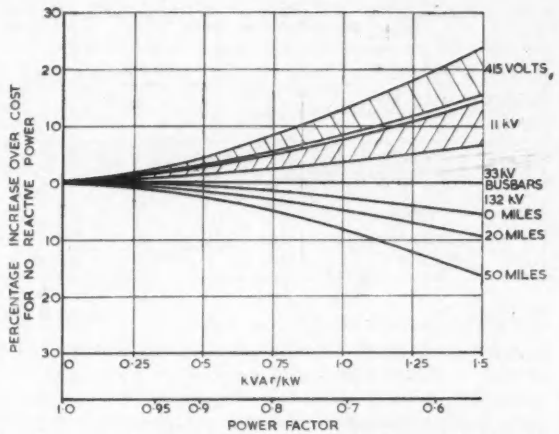


Fig. 1. Increase in annual cost for supply at various parts of typical supply system, imposed by loading at lagging power factors. Costs for transmission above 33 kV and for distribution below that voltage are shown below and above the datum line, respectively

DISCUSSION

Mr J. L. Egginton (CEGB) pointed out that in the cost calculations included in the paper series capacitors were assumed, whereas other methods of voltage control were likely to be used in practice. This made the results somewhat suspect. Regarding tariffs, he thought that the trouble was that consumers were not, taken as a whole, knowledgeable technically. The area board could offer a tariff, but not be sure it would have the result they expected. He advocated a tariff of the form £a/kW m.d. + £b/kVA m.d. This was based on the simplification that transmission and generation costs were proportional to kW demand, and distribution costs to kVA demand.

Mr C. M. Mitchell (Kennedy and Donkin) spoke of the difficulty of explaining the kVA tariff to consumers. It seemed to him that in order to recover costs correctly, a three-part tariff, unit cost, kW and kVA would be needed.

Mr F. H. Birch (CEGB) gave figures for the annual cost of various types of compensating equipment, based on 25-year life, 5½% interest and 70% load factor. *Shunt capacitors* had costs varying with voltage. At 415 V, 0·2 MVAr, annual cost was £0·4/kVAr. At 11 kV, 10 MVAr, annual cost, including switchgear, was £0·26/kVAr. At 132 kV the cost rose again; for a 60 MVAr capacitor, £0·31/kVAr. *Shunt reactors* showed costs varying sharply with size and whether switchgear was required. At 132 kV, with switchgear, cost for 15 MVAr was £0·4/kVAr; for 60 MVAr, £0·21/kVAr. *Synchronous compensators* had costs varying chiefly with the size of the unit. An air-cooled machine for a range 20 MVAr lagging output to 10 MVAr leading had an annual cost of £0·82/kVAr. For a range 100 MVAr to 50 MVAr the cost was £0·44/kVAr.

Mr Birch went on to suggest that more attention was needed to ensure that there was a reserve capacity of reactive power on the system, than to making sure that extra active power was immediately available. The rotating inertia of the system gave time to obtain more active power generation; no such lag was available when reactive power was suddenly required.

Mr K. C. Parton (GEC) thought that the calculations in the paper about the amount of compensation required were suspect, because they involved small differences between large totals. He felt that the only factor really important was to ensure that the right amount of reactive power was available to maintain stability in the face of sudden outages. If that condition were met, then there would be enough for load requirements.

Mr D. J. Bolton criticised the basis of the authors' recommendations about tariffs, saying that it was a fallacy to tie together the power factor of individual consumers with overall system power factor. If there was excess reactive power demand on the system, any one consumer should receive credit for all his reactive power generation. The kVA tariff could not possibly represent system costs. The kVAr tariff had advantages; it gave equal rewards for equal services to the system by consumers, and it permitted the power factor penalty to be varied independently of the active power charge.

Dr E. Friedlander (GEC) said that combinations of capacitor and transductor (saturable reactor) were capable of changing reactive power correction from zero to full output in as little as two to three cycles.

Mr S. C. Chu (Enfield-Standard Power Cables) said capacitors were being increasingly recognised as indispensable on transmission systems in the USA.

Dr R. A. Hore said it was not possible to operate long lines near unity power factor at the receiving end, as they became extremely sensitive to load changes. He also made the point that the optimum power factor at various parts of a system changed from year to year. It would not be possible to alter tariffs so frequently. This was an argument for putting compensating plant in the distribution system.

Mr F. Byrne emphasised the difficulty of trying to explain tariffs to consumers and suggested that reactive power should be renamed inactive power.

Mr P. d'E. Stowell (Manweb) said that one of the advantages of charging by a kVAr tariff was that consumers could be shown a figure they were paying extra to that for active power. This encouraged power factor improvement. As kVAr tariffs introduced metering complications it was not easy to measure to appreciably better than 1½%, which did not seem good enough for large consumers.

Mr F. Moores said that capacitors installed at medium voltage for power factor correction were usually controlled by a relay switching them out as the load fell. He suggested that industrialists would find it worth while correcting to a higher power factor than the authors' calculations suggested.

Mr R. O. M. Powell thought there were compelling economic reasons for using capacitors for power compensation on transmission and distribution systems.

Table I. Percentage Increase in Cost/kW for Transmitting and Distributing Reactive Power

System conditions	Increase in cost			
kVAr/kW	—	0·30	0·50	0·75
Power factor	1·0	0·96	0·89	0·80
	%	%	%	%
132 kV transmission and transformation to 33 kV (20 miles average)	—	0·5	1·4	2·9
Transmission plus distribution to 11 kV	—	1·1	3·3	6·7
Transmission plus distribution to 415 V	—	1·5	4·5	9·4

Tariffs

Analysis of tariffs offered by the 14 distributing boards in Great Britain shows that seven have adopted what is in essence a kVA maximum demand basis. Three use kW demand divided by average power factor, and one employs kVAr demand. Three use other adjustments based on average power factor.

In discussing the various tariffs possible, the authors comment that the kVA tariff has proved an excellent means of persuading consumers to limit their reactive power demands or to provide their own compensation. However, if the tariff is correct in recovering costs when there is no reactive power demand, it over-recovers when there is demand.

A tariff based on the form £a/kW+£b/kVAr permits separate adjustment of the charges. However, it can be shown to overcharge at low values of kVAr/kW, if it is correct for zero reactive power demand. Thus it may provide an incentive for the consumer to generate the whole of his reactive power demand at times of peak load, which leads to an undesirable net export of lagging reactive power to the supply system at times of light load.

These disadvantages can be overcome by changing to the form £a/kW+£b/(kVAr−0·4 kW), for example, where no charge is made for kVAr m.d. less than 40% of kW maximum demand. This gives the consumer a strong incentive to limit his reactive power demand to 40% of active power, but no lower.

A demand charge for active power only, with adjustment based on average power factor, gives advantages in simplicity of metering, but has the drawback that the average power factor may differ widely from that applying at the time of maximum load. It is the latter which determines the extra costs incurred by the supply authority.

A tariff that has been used abroad, but not in the UK, charges for active power plus a charge for equipment provided (or deemed to be provided) locally by the supply authority to generate reactive power. It has advantages in enabling the supply authority to determine what should be provided, but for equitable application, still demands metering of reactive power demand by each consumer.

Conclusions

Overall, the conclusion is that the price/kVAr in this country should be less than the price/kW, and that no charge should be made for kVAr less than 40% of the kW demand, since compensation below this level is disadvantageous from the generation viewpoint. The kW—kVAr price difference is likely to increase as the average cost of all installed generating plant rises, owing to the growing proportion of post-war plant.

Increased capital costs will be reflected in growing demand charges in kVA tariffs, which have the merit of simplicity. As a result, the scale of adjustment for reactive power resulting from kVA tariffs may tend to become excessive.

Calculation suggest that present methods of tariff adjustment provide a strong inducement to consumers to reduce reactive power demands to between 0·5 kVAr/kW and 0·2 kVAr/kW (0·89 to 0·98 lagging p.f.), by providing their own sources of reactive power. There is generally no advantage to be gained from installing further sources of reactive power on distribution systems having regard to conditions to be expected at light load.

NUCLEAR INSTRUMENTATION

AGAINST a background of rapid developments, aspects of the vital role played by instrumentation in the safe and efficient operation of nuclear power stations were reviewed last week at a symposium organised by the British Institution of Radio Engineers. Presenting the opening paper, Mr R. D. Trotter, CEGB, emphasised that nuclear stations in the UK were conceived primarily as carrying out base load duties; this fact largely determined the design of control systems installed. Base load operation lent itself particularly to centralised control enabling the cutting down of operations staff to a minimum. There was a trend towards the adoption of 50 V miniature control boards to bring overall control of the station under the supervision of as few individuals as possible, and automatic control for specific functions was being extended. The central control room was positioned so as to give the most economical arrangement of control cable runs. In earlier stations designs, the best position was considered to be the geographical centroid of area of the site. More recently, however, the control room has been placed adjacent to the reactor from which the majority of control and monitoring circuits emanate.

In the control of nuclear power stations, main burden carried by instrumentation installed was the measurement of temperature, pressure and mass flow. These variables were common to all three zones of station control, namely the turbine steam circuit, the reactor coolant circuit and finally the reactor itself. A fourth variable, pertaining only to the reactor, was neutron flux. Upon its measurement depended the assessment of thermal output (proportional to reactivity) at low powers down to the region of reactor shut-down. Under full-load conditions, thermal output was measured directly, neutron flux measurements serving only as a check. In carrying out reactor control, one of the primary aims was to avoid thermal cycling which could cause severe distortion of fuel elements.

Data logging

Papers following Mr Trotter's, described in detail, instruments and monitoring equipment developed specifically for nuclear power stations at present being built for the CEGB. Reference was also made to the Latina station being built for the Italian Government by the Nuclear Power Group. From these papers it was clear that a major instrumentation problem was the measurement of temperature at various points inside reactors. For this purpose up to 1,000 thermocouples were used in a single reactor. To monitor such a large number of elements, high speed scanning and data logging techniques have been applied. Temperature measurement was essential for the initiating of emergency shut-down of a reactor should temperature in any region within exceed the specified maximum for safe operation.

Neutron flux measurement using ion chambers was described. This involved special precautions to eliminate interference from gamma radiation. Feature of shut-down initiating devices and circuits, was inherent "failure to safety."

New wiring rules for Australia

STATE LEGISLATION BACKS 1961 CODE

AUSTRALIA has a new set of wiring rules. The Standards Association of Australia, which is the responsible authority, recently published the fifth edition of its rules, 11 years after its predecessor. The rules reflect many differences from wiring practice in the UK, and make interesting reading in comparison with familiar IEE regulations.

One important similarity between IEE and SAA rules is the fundamental basis. Both proclaim that they deal with essential requirements in ensuring safety from fire and shock, and both relate to electrical installations in buildings other than those operated by a supply authority. However, the Australian rules are backed by a collection of specifications for materials, accessories and appliances used in installations, which has more force than the equivalent list of British Standards in the IEE Regulations. Each State of the Commonwealth of Australia has prohibited the marketing of electrical equipment unless it is approved in some formal manner. Basis of approval is the specifications that comprise Part 2 of the SAA wiring rules.

General Arrangements

Changes from the 1950 SAA rules are particularly noticeable in the section devoted to general arrangement, control and protection of installations. The size of conductors or cables used has to be determined in the light of current-carrying capacity, voltage drop, temperature considerations and mechanical strength. Voltage drop is calculated with reference to extremely detailed rules for estimating the maximum demand on a circuit, and the voltage drop limit is 5%, compared with the IEE's one volt, plus 2% of nominal voltage.

Arrangement of sub-circuits is controlled by a general rule that low voltage and minimum voltage equipment rated at more than 10 A/phase has to be supplied from a separate final sub-circuit. Where appliances of smaller ratings are concerned in domestic installations, up to 15, 10 A "general purpose outlets" can be connected to a 1/·064 in. or 3/·036 in. conductor protected by a 15 A fuse or circuit-breaker. (Unlike the IEE regulations, single 0·064 in. is permitted by the SAA rules.) The "general purpose outlet" is differentiated in the SAA rules from a "plug-socket." The characteristics that distinguish the "general purpose outlet" are that it has a rating of 10 A or less and is installed within 7 ft 6 in. of the floor.

An exception is made in the case of buildings (other than domestic) having permanent built-in central heating. Whereas normally only seven "general purpose outlets" are permitted in such a case with circuit-breaker protection of the final sub-circuit (against only three with fuse protection), this number is increased to 15 where there is central heating. This change has been introduced in the latest edition of the rules. The SAA rules pay far more attention than IEE regulations to mixed circuits, in which both lighting points and power socket-outlets are connected to the same cable. There is, however, nothing resembling the ring circuit provided for in the rules.

If cables larger than 1/·064 in. are used for final sub-circuits in domestic installations, there is no limit to the number of points of 10 A rating or less which may be connected if circuit-breaker protection is used. With fuses protecting the circuit, the calculated maximum demand must not exceed the current-carrying capacity of the cable.

An interesting variation on familiar requirements occurs in the provision for a main switch to control an installation. Instead of a single switch, up to six switches, each one controlling part of an installation, may be accepted, provided the switches are placed adjacent to each other on the main switchboard and made readily identifiable.

Installing Cables

Relatively few changes are made in the new edition of the SAA rules as regards installation of wiring. However, a new rule provides that the colour green has to be reserved solely for earthing conductors. For flexible cords the new green-yellow colouring agreed on internationally is now accepted as an alternative. The specific requirements for green-yellow are that in any 15 mm (0·59 in.) length of cord each colour covers at least 30% of the surface of the cord.

The minimum size of cable acceptable for wiring of low voltage circuits is 1/·044 in., as in the IEE regulations, with 3/·036 in. or 1/·064 in. the minimum for connecting "general purpose outlets." All cables larger than 1/·064 in. have to be stranded.

In discussing jointing of cables, as in many other particulars, the SAA rules go into more detail than the IEE regulations. Special attention is given to joints in cables with aluminium conductors, which have to be made by an approved clamp-type connector of aluminium-coated or tin-plated copper alloy. This is one example of close attention to the use of aluminium which is apparent throughout the new edition of the rules. Another is prohibition of clamping aluminium conductors directly by screws in tunnel-type terminals.

Installations in roof spaces are thought to require more detailed attention in the Australian rules than the IEE regulations provide. Although cables there are recognised as unlikely to be disturbed, it is reckoned that when they cross the top of ceiling joints, they may be stepped on. To meet this circumstance, they have to be fixed at intervals of not more than 4 ft, and protected by wooden battens or something similar. Where cables are installed in spaces between floors and ceilings, they are required to be attached to the side of joists if they run parallel with them, not less than 2 in. below the floor boards; or taken through holes in the joists at least 2 in. below the floor boards. In the latter case, an alternative is provision of steel plate protection at least 0·04 in. thick covering the cable where it passes across the joists.

For cables in conduit, the SAA rules, like those of the IEE, provide extensive tables giving permissible numbers of cables for given sizes of conduit. However, when mixed

sizes are drawn into conduit, space factors to be applied differ in some respects from those of the IEE; 50% is specified when there is one cable in a conduit, 33⅓% for two cables and the IEE's generally applicable 40% when there are three or more cables.

For cable trunking, called "troughing," the space factor is 40%, compared with 45% in the IEE regulations.

Installation of equipment, which is covered in considerable detail in the SAA rules, imposes restrictions on the placing of socket-outlets that differ in many ways from IEE requirements. "General purpose outlets" have to be of flush type or otherwise designed to avoid accidental damage if they are installed within 6 in. of the floor. All sockets have to be switched, with the switch visible from the socket position and not more than 5 ft away. The exception is if a socket is installed more than 7 ft 6 in. above the floor; then the switch may be omitted. At present there is no enforced arrangement for the polarity of sockets in a socket-outlet, but an attempt is being made to standardise on earth-phase-neutral in the clockwise direction.

Earthing

The earthing section of the SAA rules has been revised in detail. An important alteration is that "general purpose outlets" are now required to be earthed, and as a result of this, the concept of "earth free" situations largely disappears as regards domestic installations. However, metalwork of equipment and appliances does not have to be earthed if it is in an earth-free situation.

The SAA rules recognise three systems of earthing: direct earthing, multiple earthed neutral and earth leakage circuit-breakers. A change in the present rules is to increase to 7/·036 in. the minimum size of bare conductor connecting the main earth terminal and the earth electrode. This compares with 7/·029 in. in the IEE regulations. There is no test requirement equivalent to the earth-loop-impedance testing which has caused such debate in connection with the IEE regulations. Simple resistance rules apply, with the maximum between the main earth connection and any point of the installation such that the protecting fuse or circuit-breaker will operate. There is a maximum of 2 ohms for resistance of the earthing system measured from connections to the earth electrode to any point enclosing a conductor. Underground water piping may only be used as an earth electrode when the buried portion of the metallic piping system is 10 ft or more in length. Where a rod electrode is used, its earthing resistance has to be such that a current at least five times the rating of the largest fuse in the circuit could flow with the nominal voltage applied across the earth electrode.

The SAA rules go into the variety of connections possible with earth-leakage circuit-breakers. Unlike the IEE regulations, they make mandatory the provision of a connection to earth electrode or to a water pipe, separate from that between the e.l.c.b earth terminal and an earth electrode. The connection from the e.l.c.b. earth terminal to its electrode is required to be in 7/·036 in. insulated conductor. The direct earthing connection may be omitted if special arrangements are being made for selective operation of several e.l.c.b's.

The SAA rules differ sharply from the IEE as regards bathrooms. Socket-outlets are permitted, although they must be at least 12 in. from the floor, 18 in. above a bath, and 6 in. away in a horizontal direction. On the other hand, there are more stringent requirements about switches, contacts of which must not be exposed merely by turning a cover. Bathrooms are covered as "damp situations" in a section of the rules devoted to special situations. This has been much extended in the new edition, with sets of requirements for many special hazards.

Boiler Circulation Research

IN a high pressure water tube boiler the passage of the steam/water mixture through the tubes is accompanied by a "slip" between the vapour adjacent to the walls of the tubes and the liquid concentrated at the centre. A knowledge of the degree of slip and its effect on the velocities of flow through the tubes is of value to the boiler designer and has recently been the subject of an extensive research programme at Cambridge University, the results of which were disclosed in an interesting paper* presented last month at the Institution of Mechanical Engineers in London. An item of particular interest to electrical engineers was that the experimental boiler employed electrical induction heating at mains frequency, uniformly distributed throughout the thick-walled mild steel tubing of the test section as the "furnace," the inductors being designed to give axial field strengths in excess of 2,000 gauss (50,000 ampere turns/ft).

The paper was divided into three parts. The first described the construction and operation of the experimental plant and a review of the associated instrumentation which included a gamma-ray installation for determining the "apparent density" of the flow from which estimates could be obtained of the relative or "slip" velocity between the two phases.

The second part analysed the experimental results obtained from the measurements of the absorption of the gamma rays, the beam of which was provided by a radioactive isotope of caesium. Tests on horizontal and vertical 1½ and 1 in. bore pipes were included in the survey.

The third part was concerned with an analysis of the pressure drop measurements made on both the 1 in. and 1½ in. pipes in vertical and horizontal positions and to a comparison between the experimental results and those predicted, after correction for the effects of "slip," from theoretical concepts.

For horizontal pipes at lower pressures, homogeneous theory gave closer prediction of pressure drop for heated than for unheated pipes owing to the opposing effects of two-phase flow conditions on the frictional and acceleration pressure drops in the heated pipes. For vertical pipes the experimental pressure drops were significantly greater than predicted by homogeneous theory, the gravitational contribution being dominant and influenced significantly by the effects of slip. Closer prediction was achieved by the introduction of a slip correction factor derived from the experimental observations.

Though not of a kind that necessarily leads to a revolutionary change in boiler design, the research has made a valuable contribution to the knowledge of processes occurring in steam raising with high pressure boilers and has given a wealth of information in a field where reliable data has been scarce.

* "Experimental Study of the Flow Conditions and Pressure Drop of Steam-Water Mixtures at High Pressures in Unheated Tubes," by R. W. Haywood, A.M.I.MECH.E., G. A. Knights, G. E. Middleton, A.M.I.MECH.E., and J. R. S. Thom, A.M.I.MECH.E.

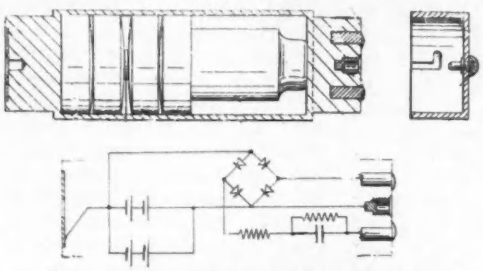
PROGRESS IN PATENTS

SELECTED SPECIFICATIONS

Rechargeable Battery

The rechargeable torch type of battery has long been an inventor's dream. Indeed, many such devices have reached the prototype stage but attempts to market them have not met with significant success. Part of the reason may be the need for external charging apparatus and part because most inventors have pinned their faith on the lead-acid type of cell which cannot, for obvious reasons, be hermetically sealed.

A new and more promising approach is outlined in Specification 864,844, attributed to the Longworth Scientific Instrument Co. of Abingdon and J. A. Jephcott. Here the conventional tubular torch battery dimensions have been



Rechargeable torch battery with in-built charger

adopted in a device which incorporates its own recharging circuit that needs only to be inserted into a convenient mains voltage a.c. lampholder. The storage cells are of the miniature, hermetically sealed nickel-cadmium type and these are accommodated in the base of the plastics casing connected as a series-parallel group. The pairs are separated by a contact plate which forms one terminal, the outer terminals being connected to form the other. Above the cells is the charging unit comprising a small full-wave rectifier of semiconductor type with a conventional current limiting and smoothing network. The charging unit is provided with mains connections to two bayonet contacts at the top of the assembly at centres coincident with those of the pins in a b.c. lampholder. The low voltage d.c. contacts are a socket in the centre of the top of the case and a circular washer at the base.

A cap, incorporating one contact and fitted with b.c. slots, covers the charging contacts when used in a torch or other device and, during charging, serves to protect the live contact at the other, over which it is a push fit, the contact pin entering a hole in the centre of the washer, so being insulated from the circuit. Refinements are also described in the specification.

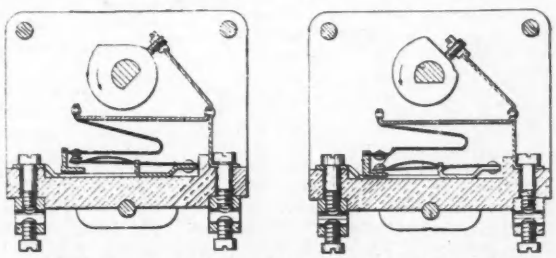
Plastics Power Cables

Power distribution cables using thermoplastic insulation, normally applied by extrusion processes, are sometimes designed with conducting layers for the purpose of stress control. Where these are of the metal foil type, some difficulty may be experienced in avoiding the inclusion of air between the conductor and plastics insulation and/or between the insulation and the metal foil layers. Standard Telephones and Cables describe, in Specification 864,832, one method of avoiding such inclusions. The foil is in the form of a metal tape, such as aluminium foil, from about six microns to a few mils thick, bonded to a layer of thermoplastic insulation such as polythene. This is lapped on to the conductor, metal to metal, and an outer coating of similar plastics extruded around, the coating and extruded plastics fusing together to form a homogeneous mass. Other stress control layers can be applied by lapping a further layer of the tape, this time with the plastics coating innermost, immediately after extrusion while the plastics is still hot enough for fusion. Further layers could be applied taking care to see that metal-to-metal and plastics-to-plastics relationships are preserved, in this way ensuring that no voids are trapped in areas of stress gradient.

A Simple Energy Regulator

Energy regulators for electrical heating appliances, in which the current is applied in a series of adjustable impulses under the control of a motor or thermal timing device, are now universally accepted for most domestic cooking and heating equipment. There have been a number of such regulators placed on the market since the first "Simmerstat" appeared and, in Specification 864,828, attributed to A.B. Specialpapper of Sweden, yet another approach to the problem is described.

The timing element is in the form of a bi-metal hairpin attached at one end to an arm projecting from a vertical L-shaped member, the deflection of which is adjustable from a cam. The other end of the element carries a contact and a small insulating plate extending under the second contact arm. The latter is part of an assembly which incorporates a quick make and break mechanism of the conventional micro-switch pattern. The hairpin ele-



A simple energy regulator for electrical heating control

ment, carrying current, opens and closes to operate the second contact arm, the interval between opening and closing being governed by the position of the fixed end of the hairpin element which, in turn, is governed by the cam mechanism. The cam, in turn, is rotated by a shaft, not shown in the sketch, to which is attached a control knob and associated dial. With the cam in one extreme position, the contacts are held permanently open since the upward movement of the second contact arm is restricted from reaching the element contact in this position. At the other extreme, the hairpin element is so constricted that the contacts are unable to part, leaving the circuit closed practically all of the time.

Reproduced by permission of the Controller of H.M. Stationery Office. Copies of specifications may be obtained from the Patent Office (Sales Branch), 25 Southampton Bldgs, W.C.2. Price 3s 6d.

Personalities *in the industry*

Mr A. H. Birch

Mr W. R. Owen

Mr E. C. E. Lyon

Mr H. L. Satchell

Mr R. W. K. Blagbrough

As part of the CEGB Regional reorganisation, to which we refer on page 605, the newly named South Western Region have appointed **Mr C. Morley New,** M.I.E.E., A.M.B.I.M., to be the Regional electrical engineer in charge of the Transmission Construction Department. His two assistants are: transmission project engineer, **Mr E. A. Burton,** A.M.I.E.E., and technical and development engineer, **Mr G. Minter,** M.I.E.E. (*ESH, pages 60, 61 and 64.) Mr New, who has been transmission engineer to the South Wales Division since 1948, was previously with CEB at Bridgwater, Swindon and Bristol, following early experience with the GEC, W. T. Henleys and the Cardiff Corporation undertaking. Mr Burton was formerly technical engineer to the Southern Division, and previously served in a similar capacity with the Merseyside and North Wales Division. Mr Minter has been technical engineer to the South Wales Division since 1948 and, earlier, was assistant technical engineer with the CEB at Bristol.

Joining the company ten years ago, **Mr A. H. Birch** has been appointed manager of the "Westair" Division of Westool Ltd., St. Helens, Auckland. He was formerly chief buyer and has been closely associated with the Westair Division since its formation in 1953.

Birmingham branch manager of Honeywell Controls Ltd., **Mr W. R. Owen,** has, in addition, been made manager of the Cardiff and Manchester branches. This follows the transfers of **Mr T. Jackson** and **Mr R. Robson** from Manchester and Cardiff, respectively, to head office positions. Educated at Newport and Wolverhampton Technical Colleges, Mr Owen has worked with the fuel department of Guest, Keen and Nettlefold Ltd., Elliott Brothers, and the Tinplate Division of the Steel Company of Wales. He has been with his present company nine years and is a Member of the Incorporate Sales Managers' Association and immediate past-president of the Yorkshire section of the Society of Instrument Technology. Mr Jackson will now be field sales manager for heating, ventilating and air conditioning controls in commercial buildings. Mr Robson will be market sales manager for metal processing industries. Two other market sales managers have been appointed, **Mr E. R. Amery,** chemical industry; and **Mr H. Wigman,** food and fibre industries.

Eastern Region British Railways have appointed **Mr E. C. E. Lyon,** electrical traction engineer, Ilford, in the department of the chief mechanical and electrical engineer. He succeeds **Mr G. A. B. Leisham,** who has retired. In 1956 he became assistant rolling stock engineer at the Ilford depot and later that year he was promoted to rolling stock engineer for the London area of the London Midlands and Eastern Region. In 1958, Mr Lyon was appointed assistant electric traction engineer, Ilford, the post he vacated to take up his new position. He is responsible for the maintenance of all Eastern Region electrified lines radiating from London, as well as rolling stock.

Mr H. L. Satchell, M.B.E., F.I.W.M., director of manufacture of AEI (Rugby) Ltd., retires this week after 41 years' service with the company. He was born in Rugby and educated at Lawrence Sheriff and Rugby Schools. In 1920 he commenced an apprenticeship with British Thomson-Houston and the following year spent 12 months with the General Electric Co., USA, under a scholarship scheme. On his return, Mr Satchell became technical assistant to the head of the winding department and in May, 1929, was appointed planning engineer. He became assistant manager of the Rugby works in 1940 and five years later was promoted to manager. He was appointed to the board in 1949 and deputy director of manufacture in 1955, becoming director of manufacture two years later. He has been chairman of the AEI (Rugby) Ex-Service Association since 1951 and held membership of the Engineering and Allied Employers' Leicester and District Association for many years, being president in the 1951-52 session.

Mr Robert W. K. Blagbrough, who joined BEAMA in 1959, and was primarily concerned with transformers, has been transferred to the electric traction section where he becomes secretary. He left Nottingham University in 1940 and, after the war, joined the Transformer Department of Ferranti Ltd., at Hollinwood. In 1951 he was appointed to the technical sales staff and gained commercial experience in both home and export fields of the industry.

North Western EB have appointed **Mr D. L. Rigby,** M.A., assistant secretary for education. He was formerly education and training officer in the engineering and development group, UKAEA. Educated at Hindley and Abram Grammar School and St. John's College, Cambridge, Mr Rigby is 35. Before joining AEA he was senior scientist with the British Scientific Instrument Research Assn., and had previously been employed at the Royal Aircraft Establishment, Farnborough (*ESH, page 155).

Managing director of the M.O. Valve Co. Ltd., **Mr J. Bell** becomes vice-chairman of the British Radio Valve Manufacturers' Association in succession to **Mr G. A. Marriott.**

Mr N. A. C. James, Southern England area manager, Cape Insulation and

** Denotes revision to the "Electricity Supply Handbook, 1961."*

Asbestos Products Ltd., has been appointed controller of the government contracts division. This is a newly created post and he will have special responsibilities of liaison with the Services and British Railways. He joined the Southern England area staff in 1950 and became area manager three years later. **Mr N. H. Wimhurst,** who has been senior technical representative in S.E. area for the last eight years, becomes the new area manager.

Mr S. S. Eriks, O.B.E., managing director of Mullard Ltd., has been elected president and chairman of the council of Electronic Valve and Semiconductor Manufacturers' Association, and **Mr C. A. W. Harmer,** O.B.E., a director of Pye Ltd., has been made chairman of the Association and of the general management committee.

Senior lecturer at the Royal Technical College, Salford, **Mr E. G. Lamb,** B.SC.(ENG.), A.M.I.E.E., has been appointed head of the department of electrical engineering, City of Liverpool College of Technology. He succeeds **Mr J. E. Macfarlane,** who has retired.

Mr E. Keith Long, B.SC.(TECH.), A.M.I.E.E., managing director of Long and Crawford Ltd., Manchester, has been appointed to the board of Lloyds Packing Warehouses (Holdings) Ltd. **Mr Peter W. Long,** director and secretary of Long and Crawford Ltd., has also been appointed to the same board.

Mr T. B. Potts, B.SC., A.M.I.E.E., has been appointed district commercial engineer in the south west (Altrincham) sub-area of the NWEB. For the past five years he has been district commercial engineer of the SSEB in the Borders district. Born at Workington, he was educated at Queen Elizabeth Grammar School, Penrith, and King's College, Durham University. He trained with the NWEB and became assistant district consumers' engineer, Penrith, in 1953, joining the SSEB the following year. (*ESH, pages 157 and 167.)

General manager of the GEC Telecommunications Group at Coventry since October, 1959, **Mr W. A. C. Maskell,** B.SC.(ENG.), M.I.E.E., F.B.I.M., SEN. M.I.R.E., has been appointed managing director of the Group. A native of Brighton, he was educated at Brighton Technical College, graduating in engineering at London University in 1925. He joined the Coventry Telephone Works of GEC as a post-graduate apprentice the same year, gaining experience in the manufacture of telephone exchanges and equipment. In 1928 he became an equipment designer in the radio development laboratory and three years later moved to head office, where he acted as technical liaison officer between the radio sales department and Coventry works. He was promoted chief engineer of the radio sales service organisation at head office in 1935 and in 1942 went as chief engineer to the company's war-time factories at Bradford. He returned to London in 1946 to become deputy manager of the radio department. Five years later he moved back to Coventry as general manager, radio works, and from 1958-59 held the position of manager (organisation) telecommunications group.

Mr S. H. Hough has been elected vice-chairman of Pitch Fibre Pipe Association of Great Britain in succession to **Mr D. Kirkness,** who relinquished office after serving in that capacity for four years.

The Electrical Research Association now announces the composition of Divisional Committee No. 4—Lines and Cables for Power Supply: **Mr S. E. Goodall,** chairman AEI (Woolwich) Ltd.; **Dr A. N. Arman,** Pirelli-General Cable Works Ltd.; **Mr R. Betley,** British Insulated Callender's Construction; **Mr P. R. Dunn,** BICC Ltd.; **Mr A. L. Fielding,** New South Wales Government Offices, London; **Mr G. H. Gillam,** Taylor, Tunnicliff and Co. Ltd.; **Mr J. H. Gosden,** CEGB; **Mr G. N. Green,** NEEB; **Mr W. G. Hawley,** AEI (Woolwich) Ltd.; **Mr G. B. Jackson,** CEGB; **Mr D. H. Kendon,** Manweb; **Mr F. J. Lane,** Preece, Cardew and Rider; **Mr W. J. Nicholls,** Aluminium Wire and Cable Co. Ltd.; **Mr G. F. Peirson,** MEB; **Mr M. J. Smith,** Enfield-Standard Power Cables Ltd. **Dr H. G. Taylor,** Director, ERA, is an *ex officio* member of the Committee, and the Secretary is **Major E. D. Gardner,** ERA.

Mr R. G. Smith of the Snowy Mountains Hydro-Electric Authority has joined the ERA Divisional Committee No. 3—Switchgear and Transformers for Power Supply.

Aylesbury district manager of the EEB, **Mr F. Bent,** retires at the end of May after 47 years in the electricity supply industry and 25 years actively in charge of the Aylesbury district. He began his training in 1914 with Bolton Corporation electricity department and was senior shift charge engineer of the generating station before his appointment as station superintendent to Aylesbury Corporation in 1929. He was promoted deputy borough electrical engineer in 1935, to which the responsibilities of manager were added the following year. He became manager of Aylesbury district EEB in 1948. His successor, **Mr B. G. Neden** (as we exclusively noted last week) has been manager of the Cambridge branch of Fens sub-area, EEB. He began his service in the supply industry with Beds, Cambs and Hunts Electricity Company and held various positions with them before becoming manager of St. Neots branch in 1946. Since nationalisation he has been district commercial engineer at Cambridge and senior assistant engineer (commercial) at Fens sub-area headquarters, Milton Hall.

Mr Robert G. Lynn retired as secretary of Hugh J. Scott (Belfast) Ltd., electric motor manufacturers, at the end of last month. He was with the company 40 years.

At the annual meeting of the Midland Centre of the Television Society, **Mr Frank Beale,** general manager, Alpha Television Services, was elected chairman; **Mr A. J. Pilgrim,** BBC, secretary; and **Mr Jack Shaw,** RIC, treasurer.

Mr J. C. Akester has been appointed a director of Hall-Thermotank Group. He is also managing director of Vent-Axia Ltd., a company within the group.

Smith's Delivery Vehicles Ltd. have appointed **Mr John Guthrie,** B.SC.(ENG.), C.A., to the board. He joined the company two years ago as personal assistant to the managing director, a position he continues to hold.

Mr P. A. Lee, of Messrs Nugent and Cooper Ltd., has been elected president of the Electrical Industries Federation of Ireland. **Mr M. O'M. O'Donoghue,** National Agencies, was elected vice-president; and **Mr H. D. McGough,** treasurer.

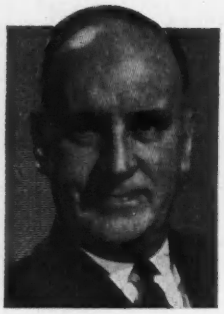
Mr H. Playle, who played a prominent part in building up Electrolux Ltd. business in Ireland, has retired from the company after 35 years' service. He

Mr. W. A. C. Maskell

Mr F. Bent

Mr B. G. Neden

Mr R. V. Ely



Mr T. S. Jones

Mr H. J. Fraser

joined as a salesman at Colchester and later transferred to Ireland, where he was appointed manager in 1927. His successor, **Mr F. A. Cunningham,** joined the sales staff of the Dublin office in 1936 and was promoted manager, Northern Ireland, two years later.

Assistant chief engineer at the Rugby works of English Electric Co. Ltd., since 1952, **Mr G. Kerensky,** B.SC., M.I.MECH.E., has been appointed chief designer (mechanical) of the Water Turbine Department, Hydro Electric Division, at the Netherton Works of the company. Mr Kerensky, who will be responsible to **Mr M. Braikevitch,** technical manager, Water Turbine Department, has been associated with water turbine installations since he joined the company in 1929 in the Estimating Department in London. Mr Kerensky is the son of Alexander Kerensky, who was Prime Minister of Russia in 1917. He escaped to Europe with forged papers at the time of the Revolution, and came to Britain in 1920, when he was 12, He went to London University, where he gained a first-class honours degree in engineering. He served in REME during the war, ending with the rank of major.

W. S. Electronics Ltd. announce the appointment of **Mr P. Corcoran** as contracts manager.

Commercial manager and secretary of the New South Wales Electricity Commission since 1952, **Mr I. M. Davis** has retired after 48 years' association with the electricity supply industry in Australia. **Mr K. C. Fraser,** formerly deputy chief engineer (generation) has now been appointed manager and secretary of the Commission. Two years ago, Mr Fraser visited Britain to discuss with the CEGB arrangements for sending NSW engineers to England for training on power plant similar to that to be installed at Vales Point.

A specialist in the field of the application of electrical transformers to arc-welding and X-ray technology, **Mr Raymond V. Ely,** M.I.E.E., M.I.MECH.E., has been appointed consultant to Gresham Transformers Ltd. He will advise the company on these two subjects. Mr Ely joined Foster Engineering Co. which became Foster Transformers in 1925. In 1935 he was appointed production director and, in 1946, managing director when the company became associated with Lancashire Dynamo. Ten years later he became research director to the Lancashire Dynamo Group but retained his seat on the board of Foster Transformers. Until the merger of Lancashire Dynamo and Metal Industries in 1959, Mr Ely served as executive vice-chairman. Since the merger he has served as a director of Roberts Holdings and Micro X-Ray Laboratories.

Dr L. R. Blake, PH.D., B.SC.(HONS.)ENG., A.M.I.E.E., has been appointed to the new post of director of engineering to Brush Electrical Engineering Co. Ltd. and has joined the board as an executive director. Since 1956 he has been with the UKAEA and prior to joining Brush he was fast reactor technology manager at Dounreay. Dr Blake received a first class honours degree in electrical engineering at Bristol University in 1944, and was awarded a Ph.D. degree by Birmingham University in 1948. From 1949 to 1956 he was head of the Electrical Section Research Laboratory of BTH, Rugby.

Mr E. F. Martin has been appointed a managing director of the Franco-British Electrical Co. Ltd. A member of that organisation for many years, he joined the board of the company in September, 1959.

Alcan Industries Ltd. announce the election of two new directors to their board, **Mr A. A. Bruneau** and **Mr R. J. Moyse.** Mr Moyse, who was appointed chief financial officer and treasurer of the company last year, joined the Aluminium Ltd. organisation in 1951, serving with Aluminium Securities, Montreal, and latterly as secretary-treasurer of the Indian Aluminium Co. Ltd. Mr Bruneau joined Alcan Industries (then Northern Aluminium) last year as secretary. His career with Aluminium Ltd., which began in 1949 with Aluminium Co. of Canada included an earlier period with Northern Aluminium, and he was latterly with Aluminium Secretariat, Montreal.

Lighting sales manager with Crompton Parkinson Ltd., **Mr T. S. Jones** has been elected president of the Electric Light Fittings Association for 1961, having served continuously on various committees of the Association since 1942. In taking over his new position. Mr Jones relinquishes the chairmanship of the Industrial and Commercial sections, but retains the chairmanship of the recently formed Import/Export Committee.

District commercial engineer, Liverpool Central district of the Merseyside and North Wales Electricity Board since 1948, **Mr H. J. Fraser,** M.I.E.E., is the new president of the Electrical Power Engineers' Association. He has been a member of the Association since 1942 and has held numerous offices—negotiating and general—at all levels, including long service on the National Executive Council and the chairmanship of the Association's national education and training sub-committee. He is a member of the NJB and the NJAC for the Electricity Supply Industry. Mr Fraser received technical education at Harris Technical Institute, Preston, and Liverpool University, and served an apprenticeship with the English Electric Co. Before joining the Liverpool Corporation undertaking as an assistant in the HV Department he was for ten years with the Yorkshire Electric Power Co. Later he became sales and service superintendent at Liverpool. Towards the end of the war he was seconded to Fulham to assist during the flying-bomb and rocket period, and this service was recognised in a special letter of commendation from the Fulham Electricity Committee.

Mr D. R. Crow, A.M.I.E.E., assistant general sales manager of the Benjamin Electric Ltd., leaves London by air on April 16, for a business tour of Scandinavia, from which he expects to return on 28 April.

Previously with CIBA (ARL) Ltd., and Ferranti Ltd., **Dr A. W. Henderson,** PH.D., B.SC., has joined the Plessey Co. Ltd., as chief chemist (metallurgist).

A certificate of honorary fellowship of the Illuminating Engineering Society was presented to the **Duke of Edinburgh** on Tuesday.

Formerly operation superintendent at Little Barford power station, Eastern Division, CEGB, **Mr G. J. Maskrey,** A.M.I.E.E., has been appointed deputy station superintendent at the Division's Goldington power station.

Mr D. J. Chapman, A.INST.E., A.M.I.N.E., has been appointed sales manager of Telequipment Ltd., whom he joined in 1958 as a sales executive after three years with Airmec Ltd.

The two assistant technical directors of the Aluminium Development Association, **Mr J. C. Bailey,** F.I.M., and **Mr F. L. Stafford,** M.I.MECH.E., are now on an extensive tour of the USA and Canada.

Mr G. Fleming has now been appointed electrical manager of Henry Tattersall Ltd.

Managing director of G. S. Peckham and Co. Ltd., **Mr E. A. V. Peckham** was elected president of the Electrical Industries Club at the annual general meeting on Tuesday.

The City and Guilds of London Institute Council have conferred upon **Mr J. F. Young,** A.M.I.E.E., A.M.BRIT.I.R.E., manager of the Electronics Division of the Donovan Electrical Co. Ltd., the Insignia Award in Technology for his thesis on "Non-mechanical Switching Devices."

Two new district managers for the Merseyside and North Wales Electricity Board are announced. At Aberystwyth the new district manager is **Mr D. A. Hamblin,** now district engineer there, succeeding Mr J. L. Williams. At Conway Valley, **Mr A. A. W. Hawley** becomes district manager. He is now senior assistant technical engineer with the South of Scotland Electricity Board. He succeeds Mr J. A. Winchester who has transferred to Crewe. (*ESH, page 139.)

OBITUARY

Former chairman of BICC, **Sir Alexander Roger,** K.C.I.E., died last week, aged 83. He joined the board of British Insulated and Helsby Cables Ltd. in 1918 and became chairman in 1930. He played an extensive part in the amalgamation of BI Cables and Callender's Cables and, in 1945, was elected chairman of the new company. On his retirement in 1954 he became honorary president. Until last year he held the chairmanship of Telephone and General Trust Ltd., and of several other telephone operating companies in Portugal and the West Indies. Sir Alexander had been deputy chairman of the Midland Bank, and chairman of Birmingham Small Arms Co. During the first war he was Director-General, Trench Warfare Supply Department, and presided over the Tank Board in the last war.

Mr Charles Herbert Lang Durrad, A.M.I.E.E., of Brentor, Tavistock, died in hospital on 3 April, aged 78.

Mr R. G. Williams, A.M.I.MECH.E., A.M.I.E.E., of Fleet, died on 9 April.

Mr F. Springate, formerly electrical engineer to Tonbridge UDC Electricity Department, has died, aged 67.

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Small Refrigerators

I NOTICED with some interest the notes by *Peregrin* on page 519 of your issue for 30 March, 1961. Really, *Peregrin* should get his facts more accurate before making comments on refrigerators such as he did in this issue.

The Jackson 2 cu ft refrigerator was introduced two years ago and not last year and, secondly, if *Peregrin* kept himself up to date he would know that both table top and legs are now inclusive in the new reduced price of our Jackson refrigerator.

On the question of whether they are silly little refrigerators, I can assure *Peregrin* that many tens of thousands of housewives do not think so and many of our dealers seem quite capable of selling them in large quantities.

A. S. Oldhams,
ELECTRICAL DIVISION OF RADIATION LTD.,
LONDON, N.W.10

* * *

I SEE from the letter from Mr Oldhams, printed above, that I was in error in saying that the Jackson 2 cu ft refrigerator was introduced last year, instead of two years ago. I must apologise for my error and thank Mr Oldhams for pointing it out to me: with the constant stream of new appliances flowing over one's shelves it is sometimes difficult to remember when each one joined the torrent. My remarks about the stand being extra was quite obviously directed at Electrolux, but I am pleased it gave Mr Oldhams a further opportunity of publicising the fact that Radiation have seen the advantage and necessity, of an inclusive and reduced price.

With regard to the large number of 2 cu ft refrigerators which Mr Oldhams says his firm have sold, this is a typical result of the wrong education of the public to the problem of refrigeration. Any constant user of a refrigerator quickly realises the inadequacy of even a 3 cu ft model for the smallest families and it is a pity that refrigerator manufacturers in general do not approach this problem in a more forceful fashion and put over to the public that 1½ cu ft/2 cu ft per person is the minimum requirement. The difference in the cost of the larger refrigerators is not so great that the public could not be persuaded to pay the extra. Good salesmanship means giving the public the best possible to fulfil its *needs*.

Peregrin.

Flex Sizes

ON 12 December last, my wife purchased a washing machine from one of the firms who sell direct to the public. This seemed to me to be a good engineering job, and I am assured that it washes very well, but I was extremely surprised to find, when I came to fit a plug to the flex, that although it contains a 2½ kW heater, this was only 23/·0076. I therefore wrote to the manufacturers on 14 December, asking if a mistake had been made.

No reply was received to my letter, so I sent a reminder on 2 January, and on 5 January an official of the firm telephoned saying that while he, personally, thought that 23/·0076 flex was somewhat on the thin side, it was the standard size used on all their models, and they had never had any complaints, but, if I was "fussy" and would purchase a length of heavier material and fit it myself, they would reimburse the cost.

Although I thought that this was a most curious procedure on the part of a reputable firm, I did purchase some 70/·0076 flex from the local area board, but discovered when fitting it that the internal connections to the heater were also all in 23/·0076. By this time I was getting annoyed, so I wrote to the manufacturers again on 10 January, expressing my surprise at the use of a conductor which contravened BS 3287. This only provoked a further telephone call on 26 January, which was taken by my wife as I was not at home, and I understand that the speaker emphatically denied that they ever contravened any standard. I wrote again on 27 January, but have had no reply at all.

It seems highly undesirable that domestic appliances with very inadequate flexes for the load taken should be on the market.

J. Mellanby, A.M.I.E.E., M.INST.F., M.I.H.V.E.,
CAMBRIDGE.

Behaviour of electrical contacts

FUNDAMENTALS DISCUSSED AT SYMPOSIUM

EVIDENCE of the widespread interest in the problems associated with electrical contact operation was manifest in the large number of papers presented at last week's symposium on the subject. This was organised by the Institute of Physics and Physical Society in collaboration with the IEE. No less impressive was the attendance of delegates, whose attention was sharpened at the outset by a clear exposition of the physics of contact phenomena by Prof Llewellyn-Jones in delivering the introductory lecture. The subject matter of the symposium related solely to light current contacts, categorised into telecommunications and so-called "electrostatic" or electronic types; heavy contacts were excluded since problems involved principally arc-extinction, considered outside the scope of the main subject.

Molten Metal Bridge

Simple at first sight, the behaviour of electrical contacts is, in fact, governed by many physical fundamentals. Presenting an important field for research in relation to telecommunications contacts is erosion, or contact metal transfer. Central to this problem is the formation of a molten metal "bridge" during part of the contact separation period. The phenomena has been the subject of special study by Prof Llewellyn-Jones and provided the main theme for his lecture.

The mechanism of molten bridge formation is initiated as contact pressure becomes reduced prior to separation. Since it is impossible in practice to obtain perfectly plane contact faces, as contact pressure decreases the total area of contact must fall, bringing about a corresponding increase in current density. The result is local heating to the extent that melting at the contact interface begins to occur. By this time, contact separation takes place, but current continues to flow, carried across the gap by a tiny bridge of molten metal which has formed. This condition is maintained for a brief instant only, when the metal suddenly boils, destroying the bridge. The whole process is completed before gap separation has exceeded much more than 10^{-4} cm. Each separation causes the transfer of a minute amount of metal from one contact face to the other, resulting in time in the characteristic pip and crater formation.

Tarnish Films

That the molten bridge should be maintained at all depends upon a complex interaction of forces. These are due principally to surface tension and electro-dynamic effects, coupled with internal circulation of liquid metal due to non-uniformity of viscosity and temperature. These factors also determine the shape and size of the bridge at various stages and hence the quantity of material transferred at each separation. Of practical significance is the effect of oxide tarnish films in stabilising the molten bridge and increasing its size. It explains why silver contacts suffer relatively little from erosion since silver oxides are unstable at the temperature of the molten metal.

Following destruction of the molten bridge, and breaking of the circuit, there occurs the familiar phenomena of contact sparking. This depends not only upon the induced voltage field across the separated contacts, but also on the presence of free electrons to trigger off ionisation of metal vapour and air in the gap. These electrons are supplied by thermionic emission from one or other of the contacts forming a cathode. For emission to take place in quantity, an important factor is the presence of a tarnish film on the contact face. The action of the tarnish film in this instance is to reduce the electron potential barrier of the metal surface and thus improve emission.

Cold Cathode Emission

Spark discharge immediately prior to making contact is also known to occur. In this instance, ionising electrons are provided by cold cathode emission, which takes place at an electric stress of 10^5 V/cm in the presence of a tarnish films thus have a vitiating effect. In addition, the only occur at extremely small contact separations, in the region of 10^{-4} cm.

For electrostatic contacts, carrying currents in the order of microamps, an essential requirement is low contact resistance. Because of their low conductivity, presence of tarnish films thus have a vitiating effect. In addition, the film's semiconductor properties produce distortion of alternating current signals.

Among topics dealt with in detail by papers following the introductory lecture, was the experimental determination of thermal and electrical properties of contact materials in the molten state. Such data is essential to the study of molten bridge formation. The technique described, which involves application of mathematical theory of molten bridge equilibrium, enables results to be obtained for high melting-point metals such as platinum and palladium. Trespassing the realms of physical chemistry, but no less pertinent to contact performance, was a paper dealing with the kinetics of oxide film formation. Another experimental technique discussed at the symposium was the application of radioactive tracers for the measurement of contact metal transfer.

Sliding Contacts

In connection with sliding contacts, details were given of research work carried out on the friction and wear of carbon. Both graphitic and non-graphitic carbon were studied; results of experiments carried out showed that presence of absorbed gases was important, and at the same time brought to light contradictions to the original Bragg theory explaining the self-lubricating properties of graphitic carbon. The use of dry plastics lubricant for metal sliding contacts was also described.

Lighting and glare

HIGHER LIGHTING LEVELS RECOMMENDED IN I.E.S. CODE*

IT is just 25 years since the Illuminating Engineering Society published its first booklet, "Recommended Values of Illumination," the forerunner of the "IES Code." In that period it has passed through a number of revisions, each reflecting changes and advancements of lighting practice with the development of better and more efficient light sources and fittings, and a general demand for improved lighting both at home and at work. It is to the credit of the compilers that the latest Code is not so much a revision of the last, issued in 1955, as a complete reassessment of the whole problem, replanned, rewritten and re-presented. It is, therefore, invidious to strike a comparison between it and its predecessors except in the very broadest of terms.

The first significant change is evident in the partitioning of the contents for, whereas the earlier Code distinguished between Artificial Lighting in Part 2 and Natural Lighting in Part 3, the present Code does not accept the distinction as separate studies but considers that the two forms must be considered as complementary in a general study of a lighting problem. Levels of illumination recommended for many occupations are sometimes difficult to obtain by daylight alone and a new approach to daylighting design, with permanent supplementary lighting in areas remote from windows to preserve an overall level of illumination, is proposed.

In regard to the basis for determining illumination levels for different occupations, the proposals made in the USA and USSR have been carefully studied, but it was decided that, in so far as this country is concerned, their adoption did not offer any advantages over the basis, proposed by Beuttell and Weston, used in earlier Codes. This has, therefore, been retained in the present edition, though there is a general uprating of recommended artificial lighting levels, in most situations of the order of 50%.

Principles of Good Lighting

Opening with a general summary of the aims of good lighting, the Code proceeds to outline the planning procedure of the brightness pattern. It is significant that here the recommended level of illumination in all working areas is stated as being not less than 15 lm/sq ft, whereas the earlier edition gave a minimum figure of only 6 lm/sq ft. In this section, some confusion may be caused by the recommendation of a diversity ratio for illumination not less than 0·7 as compared with not greater than 1:1·5 in the earlier Code until it is realised that the ratio is inverted; minimum to maximum instead of maximum to minimum.

Perhaps the most significant aspect of the new edition, however, is the importance attached to the control of glare. Whereas the word only occurs half a dozen times in the 1955 Code, by far the major part of the present one is concerned with this aspect of illuminating engineering. It is apparent that those concerned have been giving the subject very thorough study. The discomfort which can be experienced by the direct or reflected impingement of bright light on parts of the human eye is well known and the high level of lighting in the modern industrial location is all too often blamed for eye strain when the significant factor is not the high level but the faulty planning of the sources, so that light from high brightness areas impinges directly on the line of vision. This aspect of planning is given very full treatment in the Code, glare discomfort being expressed in terms of a Glare Index, the derivation of which is described in detail in the second section.

Glare Index

The Glare Index is taken as ten times the log of the Glare Constant for the installation, the latter being derived from a formula developed by the Building Research Station based on the luminance of the individual light sources, the solid angle subtended by each individual light source at the eye, the background luminance of the surroundings and a position index based on Luckiesh-Guth data for each source. The estimation for any installation is, however, a lengthy process but, where the light sources are arranged in a regular pattern as in most installations, a simple and quick method of arriving at the index has been developed from data given in two tables in the Code and the British Zonal (BZ) classification for the particular type of fitting. The classification for a number of fittings is listed in IES Technical Report No. 2, to be published shortly, while the same document shows how the classification for the other fittings can be determined.

The Code describes the application of the Glare Index to specific installations and surroundings and illustrates, by a number of examples, how it may be determined. In Part 3 the schedule of recommended values of illumination are accompanied by limiting values of Glare Index for various industrial buildings and processes, offices, schools, public buildings, hospitals, hotels, restaurants, shops and homes. Where the Index, as determined, is in excess of the recommended value, glare can be considered to be at an undesirable level and adjustments should be made. There is also an extensive description of the method of establishing Glare Indices with tables of initial indices for rooms of specified dimensions with fittings of specified BZ classification and flux distribution fractions.

Illumination for Visual Performance

In many occupations the standards of lighting for visual performance must be higher than that required for minimum amenity requirements. The relation between size of critical detail to be seen and the reflection factors involved, visual performance demanded and the illumination required are most complex. Experiment has established, however, that they may be simplified for

* "The IES Code." Illuminating Engineering Society, London. Price 12s 6d.

practical application and the Code shows how values may be determined simply on the basis of the size of critical value to be seen in minutes of arc from the viewing point, assuming near maximum visual performance estimated at 90% of ideal conditions. The relation is given as $180.S^{1\cdot5}$ ft lumens, where S is the apparent size of the critical detail in minutes of arc, and is known as the Standard Luminance. The illumination to produce the Standard Luminance depends only on the reflecting properties of the material and is equivalent to $18{,}000/R.S.^{1\cdot5}$lm/sq ft where R is the highest percentage reflection factor in the relevant detail of the task. A knowledge of the two factors S and R is therefore sufficient to enable the right level of illumination to be determined with an efficiency of 90%.

The angular size of the critical detail in minutes of arc is calculated from the size of the object divided by the viewing distance multiplied by 3,435. A nomogram is provided to enable the determination of the appropriate value of illumination to be effected, without recourse to figures, for tasks not listed in the schedule accompanying the Code.

Lighting and Maintenance

The Code does not overlook the importance of maintenance in lighting installations and, in regard to lamp replacement, favours group replacement in large installations where the lamps are installed at a considerable height. Dirty windows are also considered and, in a section dealing with designing for daylight, allowance is made for depreciation through dirty glazing when calculating the daylight factor. Values of daylight factor are listed in Table 5 as a guide to architects; indeed, it is likely that architects will find the Code of more assistance in their planning of windows and window-space than any previous edition. They will also find that the subject of permanent supplementary lighting, the level of which has been reduced to a simple formula for calculation, is adequately dealt with.

Nor does the Code omit reference to the simpler but no less important aspects of lighting planning in regard to its functions for revealing form and texture. Emergency lighting is shown as of equal importance with that for any normal movement in an area and it is to be hoped that the inadequate lighting in passages under emergency conditions which has been an all-too-common feature of many older buildings will not be perpetuated in future.

The two appendices are concerned with a short glossary of terms and a selected bibliography. In regard to the latter, it is significant that the greater part have appeared in print only since the last edition of the Code; moreover, they have been classified according to the aspect of illuminating engineering, with which they are concerned.

The Code was prepared by the Technical Committee of the IES under the chairmanship of Mr W. T. Souter. Chairman of the drafting committee was Mr W. E. Harper and the technical editor, Mr J. G. Holmes.

A.S.E.E. and Education

SPEAKERS at the annual dinner of the Association of Supervising Electrical Engineers, held in London on Friday, were much concerned with education and training in industry. Sir Hamish MacLaren, IEE President referred in his reply to the toast of the electrical industry, to the long and successful co-operation that had taken place between the IEE and the ASEE in the field of education and training. Progress in such matters was essential, he said, if Britain was to keep up her standard of living, and have something left over to help the underdeveloped countries.

Britain had good reason, in Sir Hamish' view, to be proud of the manufacturing electrical industry and also of the supply industry. The former, which he said was a curious mixture of big firms and a conglomeration of small, specialised concerns, had pioneered graduate training and had done much to train men from overseas. The supply industry had achieved success very largely because of the quality of the staff it took over on nationalisation. The ability of the industry to maintain its standards would depend largely on its ability to keep up its level of staff in the face of competition.

Grades of Engineer

Mr G. G. Kitchener, ASEE national chairman, continued the theme of training. He said that the ASEE thought there were four grades of technical employee in industry, not only the technologist-technician-craftsman trio officially acknowledged. The dividing lines between the chartered electrical engineer, the supervising electrical engineer and the technician were now so fine that all three classes were found in the electrical industry in essentially similar positions of responsibility.

The Association, he claimed, has one main object; that of being of use to the practical engineer. This was being reflected in changed regulations for the Association's diploma examination, which would in future check the ability of men to apply the solutions they proposed for problems.

He queried whether the educational system was doing enough for apprentices and called for more people to have a greater interest in apprentice training.

Principal guest of the Association was Lord Coleraine, who spoke as chairman of the National Youth Employment Council. He stressed the need for finding the right job to match the spirit as well as the ability of young people. The coming Commonwealth Training Week had as its object to bring to the notice of those in industry the vital importance of providing more opportunities for technical training.

Today's Slave

Lord Coleraine had earlier discussed the part electricity played in the present civilisation, if civilisation it was. He recalled that the Greeks held that it was impossible to have civilisation without a slave class; only in that way could the necessary leisure be assured. Electricity provided a substitute for slaves, because it took much of the drudgery out of everyday life.

In the chair for the dinner was Sir Josiah Eccles, immediate past-president of the Association, deputising for Sir Willis Jackson the ASEE president, who was engaged in the centenary celebrations of Massachusetts Institute of Technology. Sir Josiah proposed the toast of the guests, in a speech which included the warmly greeted observation, that "we in the Association fill the gap between the long-haired ones and the crew cuts."

Replying to this toast was Sir Robert Fraser, director-general of the Independent Television Authority.

PROBLEMS AND PRACTICE

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to make it easier; all make instructive reading.

Economic Water Heating

IN the circuit shown by R.T.C. (23 March), while I feel that the system has desirable features, there is a serious flaw present. The push-button "makes" the main heater circuit as well as the contactor coil circuit and, in the interval between the push-button being closed and the contactor contacts meeting, the 3 kW load will pass through the push-button contacts. Where such a circuit is adopted it is, therefore, essential for a button more robust than conventional types to be used.

The dim light of the neon lamp, when the tank is full of hot water, is presumably caused by leakage potential across the thermostat insulation, a rather doubtful feature depending, as it does, upon the insulation resistance.—*R. T. Smith.*

IN regard to the above contribution, while the idea of connecting a contactor in series with the immersion heater thermostat is ingenious, the scheme suffers from the serious disadvantage that the electric supply will be cut off when the water is run for washing-up purposes. In any case, the difference in cost between a contactor and a time-switch cannot be great.—*"Slow Neutron."*

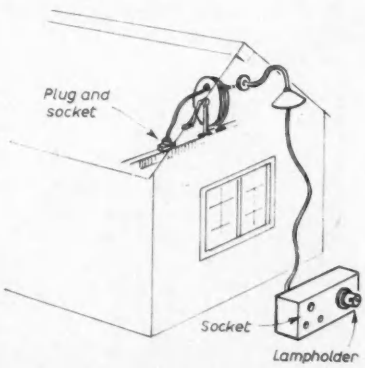
Drying Out Motor Armatures

A RECENT contribution on the measurement of motor insulation resistance and its significance reminds me of an incident which occurred in Leamington Spa in the early 'thirties, when the River Leam rose suddenly and flooded the whole of the gardens and lower part of the town, incidentally inundating the power station at Warwick. As a supply company engineer it was my task to dry out the many motors which had been "drowned" and for the purpose we commandeered the hot-room in the Spa Turkish baths. I never realised how hot such rooms really were and they served the purpose magnificently, the insulation resistance rising rapidly in a comparatively short time. Testing with a megger in these surroundings was literally a "bathing suit" job, after which a plunge in the swimming bath was most welcome.

The biggest task, however, was the diesel generator of the cinema which was submerged up to shaft level. The organ console was only saved by the combined efforts of the manager, organist and a couple of passers-by, who lifted it bodily on to the stage. To dry out the generator, it had been decided to cover it with tarpaulins and use a battery of electric radiators underneath to act as an oven. After two days of this treatment, without noticeable effect on the insulation resistance, while the boss was away, I gave orders for the tarpaulins to be removed and the diesel to be started up. The cloud of moist atmosphere ejected from the generator through the vents justified my efforts and, after a short while during which the diesel warmed the atmosphere considerably, I gave instructions for the brushes to be short-circuited and a small amount of excitation applied. Within two hours the insulation resistance was high enough for me to give the all-clear for the evening performance but, such is human nature, my superior was livid with me for going against his orders. The result, however, justified the means and I shall always hold that it is better to dry a soaked generator from inside outwards than to apply external heat.—*Ion.*

Useful Extension Lead

A FREQUENT requirement outside my workshop is an extension lead for a power point or light to enable work to be done on pieces too large to take inside. A loose coil of cable is always an untidy sort of thing to have around and I have made up an arrangement which has been found to be both useful and tidy. On a shelf in the roof of my workshop, close to one end, I have installed a drum taking 50 ft of three-core t.r.s. cable mounted on a pair of brackets, with a handle for recoiling. One end of the cable terminates in a socket fitted flush in the side of the drum and the other is led through a swan-neck bracket of 1 in. internal diameter giving access to the yard. Outside, the cable is connected to a small box incorporating a b.c. lampholder (for a lamp) and a three-pin socket (for a drill or other tool). Inside, a short length of three-core cable with plugs at each end couples the drum cable to an adjacent power point, after the cable has been run out. A conical reflector serves to protect the outside connector box from rain when wound-in and it can also be used as a high-level yard light in this position by inserting a lamp in the b.c. holder. The diagram shows the general scheme of things.—*F. R. Ralph.*



An ingenious and useful way of providing an extension lead with stowage facilities outside a workshop

Welding Cable Problem

CALLED to a factory recently to investigate burning marks on a 248/·018 in. four-core t.r.s. cable feeding the primary of a 20 kVA portable welding transformer, a spiral burn mark ran the whole length of the cable due, apparently, to overheating of one conductor. At first the blue phase conductor was suspect as, with three-phase primary and single-phase secondary, one phase carries double primary current.

On checking, however, it was found that the burning was on the earth conductor. Insulation test being good, it was obviously not caused by a fault on the primary. Further investigation soon gave the answer. Normally work was carried out near to the transformer when short flexible leads were connected to the appropriate secondary terminals. Frequently, though, work was carried out away from the unit and it was the practice to earth the welding set to the steel structure of the building by a short length of 19/·083 in. v.r.i. cable, run along heavy single-core flexible cable to the electrode holder, and complete the circuit by connecting the "job" to the nearest point on the structural steelwork.

Though welding was still being carried out satisfactorily, it was found that the 19/·083 in. cable, bonding transformer to structural steelwork, had come adrift. Consequently the 200 A welding current was returning to the transformer by way of the primary earth conductor, which had a current rating of 70 A only.—*E. Copeland.*

new products and appliances

GEC price cuts . . .

CUTS of about 25% in the retail price of all General Electric's 17 in. and 21 in. television receivers were announced last week. The reductions, which took effect immediately, were between 13 gn and 15 gn a set for the 17 in. models, and 16 gn on the 21 in. sets. The group also announced a reduction of 1 gn in the price of the GEC personal pocket transistor radio, bringing its price down to 13 gn.

. . . and Morphy-Richards reduction

The Astral 4 cu ft "Commodore" refrigerator has been reduced in retail price from £54 19s 6d to £47 5s. The company say the reason for the price cut is to bring the A.400 into line with the A.350 "Table Top" model which sells at 42 gn. The "Commodore" has a thermostatically controlled absorption unit.

GEC Ltd., Magnet Hse, Kingsway, W.C.2.

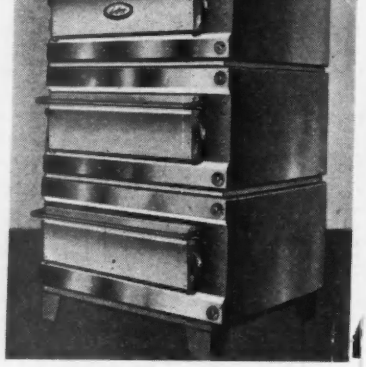
Morphy-Richards (Astral) Ltd., Conduit St, W.1.

Log-effect fires

PORTABLE fires with log effects are now available in the "Sunhouse" range. These designs, interchangeable with the coal-effect fires, are on models 302 and 303 and cost £13 and £14 4s 6d, respectively. The company have also added a 1 kW model to their range of infra-red heaters. This sells at £5 16s 2d. *H. Frost and Co. Ltd., Fieldgate, Walsall, Staffs.*

Unit baking ovens

A RANGE of commercial baking ovens, the "Loughborough," are being marketed by Essard. They are built in unit form of one, two, or three decks, each unit containing two baking trays 30 in. wide by 18 in. deep. The ovens are heated by independent upper and lower elements under thermostatic control, so that it is possible to vary the heat of either the top or bottom of the oven chamber between a range of 200°F and 550°F. A panel set to one side of the door contains the controls and pilot light, together with a damper or steam control. Each oven has a 7·5 kW loading and is finished in white and grey enamel. *Essard Ltd., Salisbury St, Loughborough.*



Three-tier baking oven by Essard

Dust- and watertight lighting fittings

DESIGNED specifically for use with closed-circuit TV installations, a range of dust- and watertight lighting fittings are also said to be suitable for use in chemical and nuclear plants and explosive factories. Three basic types of lamp are available, namely, focusing spotlight, fixed spotlight and floodlight. All incorporate a body of "top hat" section in spun steel having a welded spigot and clamp for mounting purposes. The ¼ in. thick glass window is retained and sealed by means of 12 in. diameter machined aluminium rings. Suitable for 100 W to 250 W lamps, prices are in the range £40 to £60. *P. W. Allen and Co., 253 Liverpool Rd, N.1.*

Rotary percussion drill

A NEW rotary percussion drill, the "Rotopunch," is claimed to be able to drill clean holes in a wide range of building materials, including granite. Using a ⅛ in. dia bit it combines a percussive action of 10,200 blows/min with a rotary speed of 850 r.p.m. If required, the percussive action can be cut out by means of a switch, enabling the tool to be used for normal drilling purposes.

The motor is continuously rated and the whole unit weighs only 12 lb. A typical drilling speed for Portland stone is 2⅛ in. in 30 seconds. *Wolf Electric Tools Ltd., Hanger La, W.5.*

Dust and watertight light fitting by P. W. Allen

Wolf "Rotopunch" can drill holes in a wide range of building materials

Domestic and commercial fan range

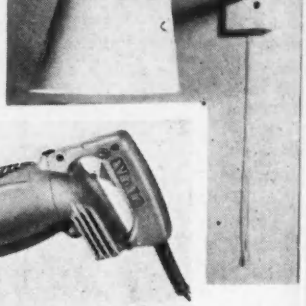
A RANGE of extractor and pendant fans for commercial and domestic use is being marketed by Metway. Of this range the "Coolerway" is designed for fitting into windows. It has 7½ in. fan blades, powered by a 25 W motor, and displaces 16,000 cu ft an hour. The fan weighs 3 lb and has a spring-loaded cover which may be fitted on either interior or exterior of the window. These models are in a price range from £5 19s 6d to £10 19s 6d. *Metway Electrical Industries Ltd., Kemp Town, Brighton.*

Hospital lighting fittings

A SERIES of lighting fittings specifically for use in hospitals has been launched by Atlas Lighting. The five fittings in the range comprise three strip lights and two lamps. Of the fluorescent models, "Amenity Pendant," available in 4 ft and 5 ft versions, gives mainly indirect light distribution. Two fluorescent tubes are mounted either side of a totally enclosed gear channel and the louvres remove easily for cleaning purposes.

A combined bedhead lighting unit provides both general light for the ward and local light on the bedhead by the use of two separate tubes. One in the upper part of the fitting gives direct light upwards and the other gives only downward light, the lower tube being separately controlled. The third of these fluorescent lights is a cove fitting giving only upward light. It retails in 2 ft, 4 ft and 5 ft sizes; there are two basic types, one with remote control gear and the other with controls inside the chassis.

Another fitting in the range comprises an incandescent bedshade operated by a pull-switch and using either a 60 W or 100 W lamp. It incorporates a 15 W "Pygmy" lamp as a "watchlight" for observation by night. Operation is by a push-button on the base of the fitting. For mounting between or under beds, the low-level night light uses a small 15 W tungsten lamp and a special louvring system which gives a lateral spread of illumination in a flat beam of 120°. *Atlas Lighting Ltd., Thorn Hse, Upper St. Martin's La, W.C.2.*



Atlas bedshade lamp with pull-switch

Petrol for pump motor cooling

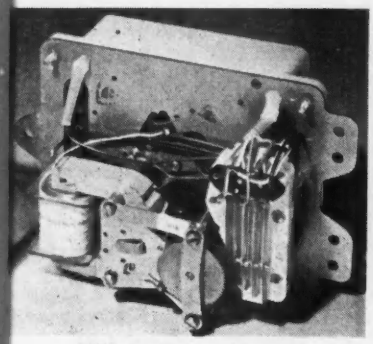
UNUSUAL feature of a fractional h.p. electric motor developed for petrol pump duty, is the use of the petrol itself as the cooling medium for the motor. Petrol stored underground never exceeds a temperature of 10°C, even under tropical conditions, and is thus ideal for this application. Previous pump motors employed air cooling, necessitating a restricted time rating or a physically larger motor. The new motor is flange-fitted to a housing which is immersed in petrol contained in the main body of the pump. Two motor ratings are available, ¼ h.p. and ⅓ h.p., and each incorporates a thermal overload trip to keep motor temperatures within the specified maximum limit. *Crompton Parkinson, Crompton Hse, Aldwych, W.C.2.*

'Fridge for the handyman

DESIGNED for the "do-it-yourself" handyman, the latest refrigerator by Lec can be assembled in less than two hours, claim the manufacturers. It has a 2 cu ft capacity and retails at 28 gn including purchase tax. Two shelves are adjustable to four positions and there are egg, butter and bottle racks in the door. The refrigerator comes in the form of a fully insulated container, together with a complete hermetic compressor unit and can be fitted under a sink or into a kitchen unit. Fully wired, the 'fridge operates from mains supply. *Lec Refrigeration, Bognor Regis, Sussex.*

Programme cycling unit

PROGRAMME cycling units for automatic washing machines are now being manufactured under licence in this country by NSF. The unit, designed by a German firm, provides unrestricted time and function facilities and is available with up to 21 contacts rated at 15 A with additional contacts for control of the timer without the use of extra relays. Type AT incorporates a special function skipping facility where the timer motor speed is increased to run through unwanted functions, with resultant time saving on the complete appliance programme. Also in this range is a thermostatically controlled rotary time switch for semi-automatic washing machines which heat and wash without intermediate attention. Variable temperature range is from 32°F to 194°F and running times can be in 4 min, 12 min, 20 min and 30 min sequences. *NSF Ltd., Alfred Pl, W.C.1.*



NFS programme cycling unit

TRADE PUBLICATIONS

ALCAN INDUSTRIES.—Booklet describing Solidal cables and their uses. Alcan Industries Ltd., Banbury, Oxfordshire.

BELMOS.—Leaflet describing DS 3 contactor starter. Belmos Co. Ltd., Bellshill, Lanarkshire.

CASTELL LOCKS.—Catalogue of recently developed interlocks and composite units incorporating switches. Castell Locks Ltd., Kingsbury Rd, N.W.9.

EVERSHED.—F.H.P. servo motor and motor generator leaflet in colour. Evershed and Vignoles Ltd., Acton La Wks, Chiswick, W.4.

FALKS.—Brochure of modern light fittings range and revised price-list. Falk, Stadelmann and Co. Ltd., Farringdon Rd, E.C.1.

PINCHIN JOHNSON.—Historical booklet by E. Kuffel, tracing the evolution of electromagnetic machines. Pinchin Johnson and Co., Carlton Gdns, S.W.1.

WILD-BARFIELD.—Leaflets giving details of vertical and horizontal general purpose furnaces. Wild-Barfield Electric Furnaces Ltd., Otterspool Way, Watford, Herts.

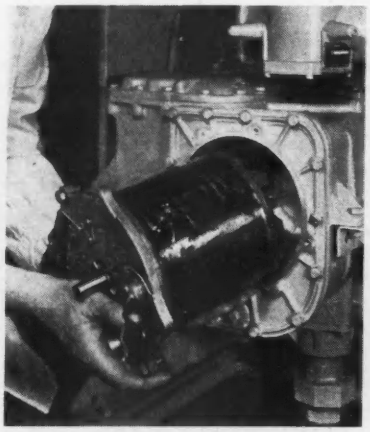
WILLIAM KENT.—Catalogue of electroceramic materials. William Kent (Porcelains) Ltd., Auckland St, Bursland, Stoke-on-Trent.

Strip heater has remote switch

A STRIP infra-red heater with a remote switch as an optional extra is the "Slim-Rad," whose element is claimed to have a 10,000 burning hour life. This radiator is 2¼ in. wide by 3¼ in. deep and there are three models in the range in varying lengths from 15 in. to 41 in. Each model can be fitted with either 250 W or 400 W elements, the largest fitting having three, the intermediate two and the smallest one. The remote switch, which is 3 in. high by 2¼ in. wide, has a pilot light. These fittings sell from £3 10s 5d to £7 13s 9d. *P and R Electrical (London) Ltd., Pearl Hse, W.3.*

Semiconductor price reductions

PRICE reductions affecting the complete range of semiconductors manufactured by the Brush Crystal Co. have been announced. Effective from 1 April, these reductions exceed 25% in the case of silicon transistors and from 10% for germanium devices. *Brush Crystal Co. Ltd., Hythe, Southampton.*



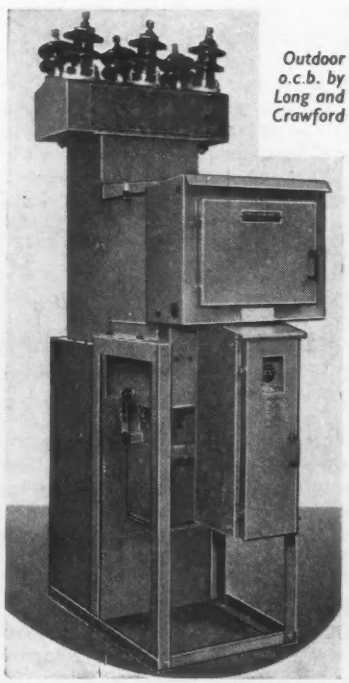
Petrol pump motor by Crompton Parkinson runs immersed in petrol

Shop lighting fitting

A 4×80 W fluorescent lighting fitting for use in stores and shops has been introduced by General Electric. It consists of an 040 Perspex diffuser with black p.v.c. ends carried on a white stove-enamelled gear tray. Switchless start gear is mounted inside the fitting and mains connection is by means of two fused terminal blocks, one to each pair of tubes. Although suitable only for pendant mounting, the fitting can be mounted within 4 in. of the ceiling, the minimum distance necessary for removing the diffuser. It is just over 62 in. long by 21 in. wide and 5½ in. deep, weighs 55 lb and sells at £45. *General Electric Ltd., Magnet Hse, Kingsway, W.C.2.*

Outdoor o.c.b. with built-in isolators

FEATURE of the new "WLD" range of outdoor o.c.b's, for operation at 6·6 kV and 11 kV, is the incorporation of built-in isolators on incoming and outgoing sides of the c.b. The isolating mechanism, interlocked to ensure off-load operation only, performs the additional function of automatically earthing either side of the c.b. when isolated. With this arrangement it is also possible to earth incoming or outgoing h.t. lines through the c.b. by leaving the corresponding isolator in the closed position. Units are available in two load current ratings, 400 A and 800 A. Each of these has short-circuit rupturing capacities of 250 MVA and 350 MVA at 6.6 kV and 11 kV, respectively. The "WLD" c.b. range was featured previously in the 23 March issue of the ELECTRICAL TIMES in connection with the ASEE Exhibition; in the caption on page 478 erroneous reference was made to an "l.t." side of the c.b., which of course is not applicable. *Long and Crawford Ltd., Gorton Rd, Manchester, 12.*



Outdoor o.c.b. by Long and Crawford

NOTES ON WIRING

BY MEGOHM

MY one-page survey of the Electrical Engineers' Exhibition last week ended after I had discussed some of the accessories and lighting fittings on show. I am back for a second week, exceptionally, to comment on some other features of the Exhibition—although even with this extra space, much that was of interest at Earls Court will have to remain unmentioned.

Switchgear

There was so much switchgear on view that it would have taken all week to look at it properly. Certain switchgear manufacturers also market accessories and it is on such stands that life begins to be rather hectic. Simplex Electric displayed lighting fittings also and a fine range of automatic control gear. Underfloor duct systems and underfloor heating systems are specialities of Simplex, and their representatives were most eager to discuss these with visitors. Of course, the Creda Corvette was also on show, and I do not hesitate to repeat that I consider this to be an excellent piece of apparatus. Their cooker control too was of special interest and Simplex were amongst the first people to realise the increasing size of the domestic cooker.

Crabtree displayed a most realistic fireside scene in keeping with their publication "Design for Living." Many visitors must have looked longingly at the comfortable chairs. I didn't get a chance to sit down for I was immediately taken over by a representative of the firm and shown a most impressive new line of moulded circuit-breakers called the "Crabtree-Magrini" range. From 100 A to 800 A in size these breakers are designed for use in switchboards, control centres and distribution boards and can be supplied with a wide range of terminal arrangements, tripping features and auxiliary contacts. The cases are of all-insulated moulded construction and the mechanism is equipped with special anti-weld silver-alloy contacts. I feel certain that we shall see much more of this range, for the switchboard on display showed that they were very space-saving indeed.

Other Crabtree features were the new multi-pole relays which should prove very useful indeed. They are of the four-pole type and arranged so that an additional four contacts can easily be clipped on the original unit. The m.c.b's marketed by this firm were in the forefront, especially the consumer unit type which made its appearance at last year's Exhibition.

MEM also had an impressive display of switchgear and accessories. The two socket-outlet units which I described recently as the "bedside" and "fireside" units are extremely useful and I have had two in use for some weeks in my own house. They have proved themselves and will remain as permanent features. I have watched with interest the changes in this firm's switchgear during the last two years and would say that it is now amongst the best in the country. It is well-designed, roomy and pleasing.

Walsall Conduits had a new range of rocker-type switches called "Walrok," a miniature plug-in busbar trunking and a hospital bed service unit which is quite revolutionary. This last feature, designed to mount on the patient's locker and served by leads from a special wall unit which has a three-pin 13 A socket and a 12-pin Plessey socket. The unit has the usual features required at hospital bed positions. Also on display were shaver units suitable for 230 V and 110 V. Walsall conduit and fittings are, of course, known throughout the world and the firm offers a most impressive range of goods. I particularly like their watertight switches, etc., which I feel could be relied upon to do their work under the very worst conditions.

Wandsworth Electrical are renowned for their very fine finishes and first-class switches. They have recently produced a 13 A switch-socket with metal plate and metal dolly. The "Wempress" range of rocker-type switches has met with general approval and to match this range, switch-socket outlets are now available with the rocker switch. A fine range of incinerators was on display, including the now familiar model which is fitted flush into the wall.

Bells and Chimes

Bells and chimes always attract people, so much so that on Friedland's stand a hidden switch cut off the supply to the various pieces of apparatus on show. "Small boys" was the excuse given but I fear that these small boys were rather old in the tooth. Not that I blame the people manning the stand, to add bells to the atmosphere of Earls Court is not conducive to peace of mind! I tried almost every chime and bell on the stand—but then I had a good excuse!

Quite seriously, the tone of Friedland's "York," "Cathedral" and "Monarch" chimes is really lovely and the "Westminster" chime provides for an eight-note chime for the front door, a single note for the back door and a different single note for another door, all contained in a polished mahogany case, size 13½ in. by 8 in. by 3¼ in. Having only one door in my house, I would go for the "Cathedral" unit. I intend to look to this firm's products to solve another minor problem, that of finding the keyhole in the dark, especially after visiting Earls Court! Their Pushlite is the answer. A combined push and nameplate also gives enough light to illuminate a namecard and the elusive keyhole and sells at the price of 9s. Other pushes made by this firm include those with the black button surrounded by the light, the conventional push for the door and a hanging pendant type push in ivory plastics. Transformers to operate all these accessories are also available.

The General Electric Co. displayed a 17 ft long control console made for a steelworks and around this were other types of control gear, right down to installation equipment. Their "Mutac Clipper" range of a.c. accessories were well to the fore. I described this range some months ago and more recently I commented on the extended range which caters for industry and those who require a decorative brass finish to their switches. I also noted that 15 A and 30 A insulators have been added to the "Hidutac" range and these should prove useful to the contractor. The "Hidutac" range is very competitive and extremely well made. The contractor, of course, is always on the look-out for such ranges and I think that this particular make should answer his purpose, especially as it now has the isolator, so that everything can "match up."

News of the Week

Regional Reorganisation by C.E.G.B.

New Responsibilities for Renamed Regions

FURTHER steps in the reorganisation of the regions of the Central Electricity Generating Board have now been decided upon. These also involve changes in the existing omnibus titles, in use since regionalisation, to much shorter names. Thus, Eastern, London and South Eastern Region will be known as South Eastern Region; the Southern, South Western and South Wales Region becomes the South Western Region; the Midlands and East Midlands Region is now the Midlands Region; the North Eastern and Yorkshire Region is to be known as North Eastern Region, and the North West, Merseyside and North Wales Region will be renamed North Western Region.

There are also changes in the titles of the various Divisions which henceforth will be Divisions of the Regions and not of the CEGB. The new South Eastern Region will have only two Divisions: North Thames (taking over the present Eastern Division) and South Thames (absorbing S.E. Division); the present London Division disappearing in the process. The new South Western Region continues with three Divisions, only the South Western being renamed "Western."

Likewise, in the Midlands Region, there will continue to be two Divisions: West Midlands and East Midlands; while in the North Eastern Region the North Eastern Division is renamed "Northern," and Yorkshire Division becomes "Southern."

In all Regions (except North Western) the reorganisation plan envisages the adoption of a Regional Transmission Construction Department, under a regional electrical engineer. Such appointments in the Midlands Region we noted last week; in the North Eastern Region we reported on 23 Feb.; and the South Western Region appointments are reported on page 594. It is likely that other changes will be made as the reorganisation progresses.

Henceforth, the Divisions will be concerned only with operation of the power stations and transmission systems within the Division (ESH, pages 54-73).

W. THURROCK ORDER FOR A.E.I.

ASSOCIATED ELECTRICAL INDUSTRIES are to build a third 300 MW turbine-generator for West Thurrock station. Together with two 200 MW sets ordered from C. A. Parsons, the first of which is due for commissioning this year, and the two 300 MW sets which AEI are at present building, this brings the total capacity on order for West Thurrock to 1,300 MW.

The latest set, due for delivery in 1964, is worth £2·3 million, and takes the total of AEI orders for West Thurrock past the £7 million mark.

AEI Constructions (Cables and Lines) Divisions have also received an order for 275 kV line towers to reinforce Leicester's supply from Castle Donington station.

A.E.I. to close Switchgear Plant

AS part of their consolidation programme, Associated Electrical Industries are to close down a switchgear factory near Liverpool over the next four months. The factory, on a Government-sponsored estate at Huyton, has been operated by AEI under the Metropolitan-Vickers banner for the past five years and employs 300 workers. Another firm is interested in taking the factory over and is at present negotiating with the BoT; the firm has not been named but is believed to be an electrical manufacturer.

Industrialists Share Scientific Equipment

A UNIQUE scheme for the sharing of scientific equipment by industrial companies in S.E. England has been announced by the FBI's London and S.E. Region. List of items they are prepared to lend and would like to borrow or have access to are being circulated by the majority of the 126 firms in the Region's research directors' discussion group.

Wylfa Inquiry Next Month

THE public inquiry into the proposal to build a nuclear station of up to 800 MW at Wylfa, Anglesey, will be held in the Memorial Hall at nearby Amlwch on 30 May, at 10.30 a.m., and subsequent days if necessary. The Minister of Power has appointed Mr H. W. Grimmitt, C.B.E., M.I.E.E., M.I.MECH.E., chief engineering inspector of the MoP, and Mr E. Farricker, M.T.P.I., principal inspector of the Ministry of Housing, to hold the inquiry. The question of building a 400 kV double-circuit overhead line across Anglesey and the Menai Straits to a proposed new substation at Pentir, on the mainland, in the event of Wylfa being approved will also be considered.

NEW CHARGER FACTORY FOR INVERNESS

PLANS for a new factory in Inverness to manufacture automatic battery chargers, etc., were announced by Lord Strathclyde, chairman of NSH-EB last week. The company launching this enterprise is Partridge Wilson and Co., whose chairman and managing director, Mr H. G. A. Ross Wilson, said that £25,000 would be initially allocated to the project.

This is another enterprise to come to the North as a direct result of the hydro-electric schemes. Since 1949 some 228 new industries, employing 13,500 people, had been established in the Highlands. Most of the employment is centred, naturally, on the major projects at Dundee and Dounreay, but some 200 smaller industries are already employing about 5,000 workers.

The Provost of Inverness, Mr R. Wotherspoon, confessed to having been an opponent to the hydro-electric schemes, but today he was a fervent admirer of all that the Board had done and he regarded it as the greatest benefactor to have entered the area.

MINING ELECTRICIANS' RULES

CHANGES are proposed in regulations governing electrical working in mines. Ministry of Power Safety Circular No. 245 gives the details. One of the main alterations affects 8(3) of the 1956 regulations, which prohibits work on live conductors at voltages above 25. Cleaning of slip-rings and commutators of voltages up to 650 is already exempted. It is now proposed to extend the exemption to certain telephone and signalling apparatus and equipment, such as batteries, certain test apparatus used in surface workshops or on electric winding apparatus at the surface, and apparatus for insulation or conductance testing.

Regulation 13(2) of the 1956 regulations is to be altered to permit men already in post to continue to take charge of electrical equipment at a large mine in the absence of the electrical engineer, even if they have not the technical qualifications at present required by the regulations.

Objections to the changes in the regulations have to reach the Ministry of Power by 21 April. The changes have already been discussed with representatives of employers and employees.

BETTER INSTRUCTIONS RECOMMENDED

Inquest on Keighley substation deaths

MORE comprehensive instructions for switchgear were suggested by the jury on Friday when they returned a verdict of "death by misadventure" on two men killed last month in an explosion at YEB's Sawmills substation, Keighley. The jury also recommended that people allowed to operate the switchgear should be familiar with all types, for it was established that while one of the dead men, Mr J. Thwaite, 56, second assistant district engineer, was the authorised person to operate the switch, and did attempt to do so, he appeared not to have operated that type of switch before. The other dead man, Mr A. Clarkson, 40, chargehand jointer, seems to have had no direct hand in operating the switch.

In his summing-up, the Coroner, Mr S. E. Brown, said that Mr Thwaite may have been failing to concentrate and have moved the switch in the wrong direction, so creating an arc which caused the explosion. If the movement had been carried out with the safety the makers had intended, two safety padlocks found on the frame at the side of the switch would not have been discovered in that position.

During the evidence, Dr B. F. Salvage, of Leeds University's electrical engineering dept., said the seat of the fire was the oil-immersed isolator. The explosion had been caused by severe arcing between contact blades and earthing contacts. For an engineer, if the precautions were correctly observed, the switch should have been safe, but it was vitally important to follow the correct procedure. Asked whether he had understood the instruction on the switch, he said: "I did not find the instructions completely clear at first because of lack of details. I did not fully understand it until I had examined the whole of the switch." He said the padlocks on the switch should have been replaced after operation and this was not made clear in the instructions. Nevertheless, he contended that putting the switch from "off" to "earth," instead of "on," could not arise from any misunderstanding of the instructions; that would be human error.

Earlier, Mr J. H. Hooper, who had fainted when visiting the scene shortly after the accident, said he was satisfied that the only reason for the explosion was the inexpert or improper operation of the switchgear by Mr Thwaite. In his summing-up, however, the Coroner said there was no clear evidence to show what had caused the accident.

WORK STARTS ON SIZEWELL SITE

THE five-year task of building Sizewell 650 MW nuclear station began on schedule last week when site preparation was begun by the English Electric-Babcock and Wilcox-Taylor Woodrow Atomic Power Group. This brings the number of nuclear stations under construction in the UK to seven with a total guaranteed output of 3,075 MW, with a further 550 MW station already approved for Oldbury, Glos., and consent sought for a station at Wylfa, Anglesey, of up to 800 MW. Sizewell is the largest nuclear station under construction in the world, so far, and also the most compact in design, occupying 24 acres.

Apprentice School Opens

AN apprentice training centre has been opened at Stella South power station by the CEGB to train boys in the use of hand and machine tools, welding, forge and anvil work, and working from drawings. This school, with a capacity of up to 30 pupils, is the first of its kind in the north east and the third in the country.

Nearly 1,200 copper segments, weighing 2,400lb, are being assembled at the GEC Witton Works for this 94½ in. dia. commutator. It is part of an 8,000 h.p. 142 rev/min double-armature d.c. motor, one of six which will drive the finishing train of a 68 in. hot strip mill being constructed by Richard Thomas & Baldwins. These motors form part of a £2¼ million order awarded to GEC last year

G.E.C. TO CLOSE DUNDEE BRANCH

COINCIDING with an economy drive in staff, General Electric Co. are to close their sales and distribution branch at Dundee in about two months' time. No details of staff redundancies have yet been released, but a company official has denied rumours that there are to be mass dismissals of workers at the Swinton factory, which makes cookers. Some temporary workers, taken on two months ago when orders increased, had now been laid off as the order book was back to normal, he explained.

OFFICIAL PUBLICATIONS

Ministry of Power Safety Circular No. 245. Draft Coal and Other Mines (Mechanics and Electricians) (Variation) Regulations, 1961. HMSO. 3d (see page 605).

Ministry of Labour. Unsealed Radioactive Substances Regulations—Preliminary Draft of Regulations. HMSO. 1s 3d (see this page).

Factories Bill. HMSO. 6s 3d (see page 607).

Central Transport Consultative Committee for Great Britain. Annual Report for the year ended 31 Dec., 1960. HMSO. 1s (see page 609).

Economic Survey, 1961. HMSO. 3s 6d (see pages 582, 608).

IES Code. Recommendations for Good Interior Lighting, 1961. 12s 6d (see page 599).

A Guide to Arc Welding Electrodes. BEAMA. 5s (see page 608).

ERA Publication:

C/T122. Automatic Operation of a Medium-sized Wind-driven Generator Running in Isolation, Preliminary Report. J. G. Walker. 12s.

BS 3337. Dimensions of plug part and lampholder for capless photoflash lamps. 5s.

Financial and Economic Obligations of the Nationalised Industries. HMSO. 1s.

Radioactivity Rules

REGULATIONS governing the use of unsealed radioactive substances in factories have been published in preliminary draft form by the Ministry of Labour. The code now available is complementary to that on ionising radiations in sealed sources which we noted last week. Comment on the preliminary draft is invited, to reach the Ministry by 31 July next. The code is concerned with precautions to be taken when unsealed radioactive sources are used, and with the medical testing of workpeople exposed to ionising radiations from such radiations. Conditions and methods of working with unsealed radioactive sources are laid down in some detail, and a schedule defines permissible radiation doses, maximum permissible levels of contamination, and amounts of various radionuclides which may be stored under defined conditions.

A.E.I.—G.E.C. Increase Co-operation

FOUR months after forming a joint company to manufacture and sell glass products, largely concerned with lighting and valves, AEI and GEC have announced a similar joint venture with regard to metal components. The new company will begin trading as a separate entity within a few months, with headquarters at North Wembley, and will make products of molybdenum, tungsten and other metals for the electric lamp and radio valve industries.

New Group Formed

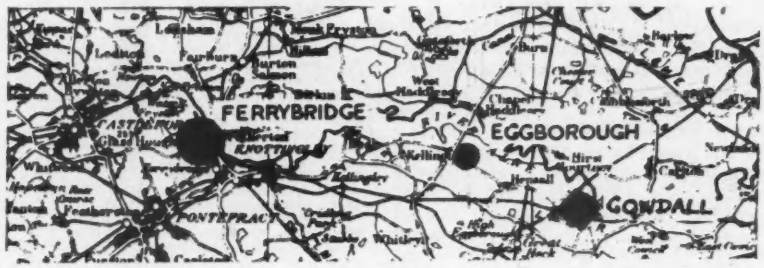
BRENTFORD Transformers Ltd., whose Crawley factory specialises in voltage regulation, are one of three private companies merging with General Hydraulic Power Co. to form a group to be known as GHP Group. The others are Hugh Smith (Glasgow), heavy machine tool engineers, and Langley Alloys, while the existing GHP company makes port and railway equipment, lifts and other hydraulic gear. Mr D. H. de Trafford, who is chairman of each of the three private companies, became a director of GHP in 1959.

Directors of GHP estimate that combined profits for 1961 will be not less than £330,000, an after-tax earning rate of 13½%; if so, it is the intention to pay a 7% dividend against 1960's 6%.

FINNISH TARIFF SURPRISE

BRITISH electrical manufacturers look like having an even better market opportunity in Finland than was expected, for it transpires that her new trade terms to Russia are identical with those accorded to EFTA countries, not more favourable as was generally expected. Not only are the tariff privileges the same, but the goods on which the 1 July reduction will be 20%, instead of 30%, and further cuts retarded are also the same. As mentioned in the ELECTRICAL TIMES last week, the only electrical goods to which this applies are generators and electric motors weighing not less than 250 kg, for which Finland is presumably fostering her own industries.

Sites for two more stations



TWO new power station sites in the West Riding of Yorkshire, each suitable for a 2,000 MW station, have now been decided upon by the CEGB. Suitable sites for large coal-fired stations have been found adjacent to the Board's existing site at Ferrybridge, and at Eggborough, about four miles east of Knottingley. The CEGB have this week applied to the Minister of Power and the West Riding County Council for the necessary statutory consents. If authorised, the stations will incorporate the latest type of large highly efficient boiler and turbine units.

Both sites are on the eastern fringe of the Yorkshire coalfield, which possesses large reserves, and the National Coal Board expect in future to supply substantially increased quantities of the small coal burnt in power stations.

The Ferrybridge site, where two power stations with an aggregate capacity of 470 MW are now in operation, already has a rail connection; and coal can also be transported by barge. The Eggborough site can be rail-connected by a short spur off the Wakefield-Knottingley-Goole railway. Both sites are on the River Aire, the only adequate source of cooling tower make-up water in this part of the coalfields.

The CEGB, who are anxious to begin early construction of the stations to meet the rapidly increasing demand, have also found a third site, on the River Aire at Gowdall, believed to be potentially suitable for a subsequent power station. Further investigations are also required into the problems of a station on the River Don additional to the 1,100 MW Thorpe Marsh station now under construction.

It will be recalled that the CEGB announced last June that it was investigating six possible station sites in the West Riding of Yorkshire: adjoining Ferrybridge and Thorpe Marsh, and Knottingley, Kellingley, Eggborough and Gowdall.

Cable Order

ANOTHER order has been placed for the flat pressure cable of which Enfield-Standard Power Cables Ltd. are the sole UK manufacturer. Two contracts worth £150,000 received by the company from Eastern EB include over six miles of 33 kV flat oil-filled pressure cable.

Durham Disappointed at no New Station

A CHANGE from the usual protests about power station sites comes from Durham, where there is widespread disappointment because the chances of a new station being erected on the coalfield are remote. No doubt bearing in mind the station being erected at Blyth, which will take its coal from the Northumberland field, Durham County Council recently urged the MoP to build a station in their area to ensure the future of the Durham coalfield. But the MoP indicated that Durham has neither the large rivers needed for cooling modern-sized stations, except the Tees and Tyne where stations have been built in recent years, nor the flat coast for seaside stations. The CEGB said recently that they have no further plans for further stations in the North East other than Blyth.

Unifying Factories Legislation

THREE separate Factories Acts are at present effective in controlling matters affecting safety, health and welfare in factories in Britain. They are consolidated into a single measure in the Factories Bill which has been introduced in the House of Lords and which is intended to become operative on 1 April, 1962. The new Bill makes no changes in the existing law; it is concerned only with bringing together existing requirements in one document. Besides the Factories Acts of 1937, 1948 and 1959, the new Bill will replace some minor legislation affecting conditions in factories.

IMPOSING ENTRANCE TO ART GALLERY

An atmosphere of imperious dignity is achieved by this electrolier recently installed in the main entrance of the National Gallery, London. Specially designed by Hiscock, Appleby and Co., the fitting has 24 lights and consumes 3,600 watts. The frame is polished brass and the diffusers are crystal skirted by finely lined clear glass.

NEW AGREEMENT FOR PLESSEY

PLESSEY have expanded their interests in the refrigerator component field by concluding an agreement to manufacture under licence Rini thermal overload protectors and starting relays. The agreement gives Plessey exclusive marketing rights in the UK and non-exclusive rights elsewhere, except that they may not sell in Italy. The range of Rini, of Milan, includes patented relay-protectors which combine overload protection and relay control in a single unit.

Guide to Arc Welding Electrodes

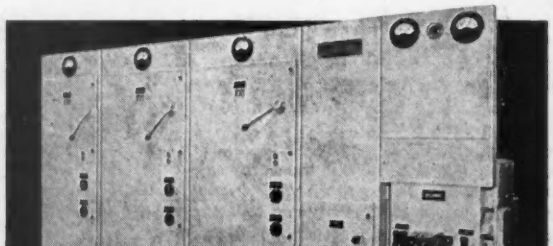
A NEW and completely revised 100-page edition of their "Guide to Arc Welding Electrodes" has just been published by BEAMA, price 5s. Intended to assist the user in the choice of suitable electrodes for each purpose, the Guide includes tables listing the electrodes for various types of steel, aluminium, hard surfacing, cast-iron, tin-bronze, aluminium-bronze and nickel. A brief description of the British Classification of Electrodes is included, along with a more complete description of the American method of classifying electrodes.

Collaboration on airborne radio

AN English Electric subsidiary and an American company have agreed to pool technical resources in the field of airborne radio and radar equipment. Either of the two companies, Marconi's Wireless Telegraph and Wilcox Electric Co. of Kansas City, may manufacture and sell the equipment designed by the other.

Control board for Jersey

As part of the urgent efforts to improve Jersey's water supply Erskine Heap and Co. have been called upon to provide the automatic multi-motor control board for the new pumping plant. This is for use in connection with the new reservoir being constructed following last year's drought. The reservoir will provide storage for 220,000,000 gal. with a pumping capacity of 150,000 gal/hr against a 300 ft head. The control board, shown in the accompanying illustration, is typical of the Erskine Heap range



OUTLOOK FOR 1961

ORDERS on hand in the engineering and electrical goods industries at the end of 1960 were about 20% higher for both home and export markets than at the beginning. This is stated in the Government's *Economic Survey, 1961*. Production of capital goods by the industry increased during the year, although rate of expansion slackened after June. Production of consumer goods dropped, then levelled off.

The survey forecasts that the economies of Western European countries, including the UK, and of Japan, will probably expand in 1961, and says it is reasonable to expect some recovery in North America. On the other hand, imports by countries mainly dependent on exporting primary products are likely to decline.

UK exports may be expected to benefit from any expansion of world trade, but only if they are competitive in price and delivery and if salesmanship is sufficiently vigorous.

So far as home sales are concerned, BoT inquiries indicate that firms in the manufacturing industry are planning to spend 30% more in 1961 than they did in 1960, and that there will be a 10% increase in investment by distributive and service industries. Building of private houses is expected to run at an increased rate during 1961.

During 1960, average price of the products of manufacturing industry were nearly 2% higher than a year earlier. During the year, output per man changed little on average, although earnings were up. Direct labour and service taken together accounted for 62% of total manufacturing costs.

TV stocks still drugging market

DESPITE general price cutting and reduced production, stocks of TV sets in the hands of manufacturers and distributors are estimated to be still around the 900,0000 mark, only 100,000 less than at the beginning of the year. Evidence of the industry's troubles has been given by GEC, who last week outdid other makers and slashed 25% off the price of most models; also their bid for Radio and Allied (Holdings), which seems to be going according to plan, is an example of rationalisation on the manufacturing side. The trade is blaming poor sales on the minimum 20% h.p. deposit, but the fact remains that with nine-tenths of Britain's homes already equipped with TV, the market is becoming increasingly restricted to replacement. The beginning of regional transmissions in West and North Wales, due in autumn, 1962, will provide some welcome, but relatively minor, new ground.

The introduction of 19 in. sets by some manufacturers has had little overall impact, for retail sales in February showed the usual seasonal downturn, dipping to 5·1 sets per shop from January's average of 6·3, and remaining at about two-thirds of the 1960 level. Radios, however, have continued to do well, with February's average of 11 sales per shop only fractionally below January.

COPPER SURPLUS PERSISTS

REDUCTIONS in copper output in some of the main producer countries have not been sufficient to eliminate a world surplus, which is currently running at about 150,000 tons a year. Sir Ronald Prain, head of one of the largest producers, Rhodesian Selection Trust, forecast last week that excess production would persist until 1964, though a business recovery in the US might alter the metal's statistical position in the course of a few weeks.

The current surplus is small in relation to world production of about 4·5 million tons, but Sir Ronald Prain said it is enough to determine the price trend, while in the short term, price outlook is confused by political uncertainties in some producer countries.

Outsize oil-filled cable

THE 230 kV cable recently completed by BICC for Ontario Hydro is notable not only for its size and rating, but also because it will be directly buried with water pipes to permit subsequent uprating, if required. The cable will provide two three-phase circuits between Haig Junction and Applewood Junction in Toronto, each circuit rated 540 MVA at 100% daily load factor rising to 680 MVA at 75% daily load factor, should the adjacent circuit be out of commission. The cable was manufactured at the company's Erith works and consists of six stranded segmental conductors with a total cross section of 2·16 sq in., laid round a central oil duct. A reinforced lead alloy sheath has corrosion protection of self-vulcanising rubber, p.v.c. and hessian tapes. The reinforcement is by bronze tapes, applied over the lead alloy sheath. By laying the cables with ¼ in. dia polyethylene water pipes, it is anticipated that the cable capacity can be increased in future with further load growth. In a paper presented to the last CIGRE session, Ontario Hydro indicated that water pipes laid adjacent to cables could increase the load capability by as much as 50%.

TRANSPORT MUSEUM AT CLAPHAM

HISTORICAL treasures of two centuries in the field of transport have been gathered together by the British Transport Commission and given a home at Clapham Common in the only permanent exhibition in the country devoted entirely to public transport. The first section of the museum, which opened recently, contains models, pictures, maps and posters and smaller items which trace the evolution of transport for 200 years.

The museum is housed in the former London Transport garage and depot at Clapham and a further display of some of the older trams, trolleybuses, petrol buses and coaches will be shown at a later date. Also in this section will be railway carriages, some of them used by Royalty, locomotives and canal craft.

Circuit-breakers to cope with floods

FIVE 132 kV 3,500 MVA oil circuit-breakers which GEC are to supply for the CEGB substation at Cardiff East will be modified to permit operation even when the area is flooded to a depth of 4 ft. Each operating cubicle will be placed on a platform above that level, and as a result both the cubicle and the drive rod will have to be modified. The substation was flooded last winter, and it has been decided to increase the clearance allowed by the existing units, which are not of GEC manufacture. The order is worth £83,000 and installation is due to start towards the end of this year.

TRAINING SCHOOLGIRLS

BY concentrating more of its future work on schools the Electrical Association for Women could ensure that girls leaving school would be properly equipped to run the all-electric houses they would have in the future, Miss Mary George, director of EAW, stated at the annual dinner of the Bristol and District branch. "The dimmest-witted girl in the lowest 'D' stream will get married when she leaves school and fill her house with all the electrical appliances her husband can afford," she said. The Association would have to find ways of bringing the use of electrical appliances to the level which the "C" and "D" streams could assimilate, she added.

PASSENGERS' VIEWS

INSUFFICIENT testing of electric trains in the North Kent electrification programme is blamed for rough riding of the trains in the annual report for 1960 of the Central Transport Consultative Committee for Great Britain. The committee, which includes representatives of local authorities and of commerce and industry, says that bad running is not confined to the Kent services.

Trouble is becoming apparent in all parts of the world as average train speeds increase.

In the case of the North Kent electrification, such tests as were made proved deceptive as weaknesses did not become apparent immediately. Once they did become apparent "conditions deteriorated rapidly," causing not only dismay but alarm to many passengers.

The committee says that some trailing coaches on the existing coach sets are being modified by fitting a different bogie, but this is not possible with motored bogies. These are being modified, and it is hoped that they will be satisfactory.

Elsewhere in the report, which is extensively concerned with the closing of branch lines, the possibility of an extension of the Bakerloo tube line in South East London is discussed, but it is thought not to be justifiable despite admitted inadequacies in travel facilities in that area.

Late running of trains receives attention in the report, with the significant comment that the Southern Railway, with a considerable proportion of electric services, has a much better record of punctuality than other regions.

OBJECTION TO SUSSEX LINE

CUCKFIELD UC are seeking support from other local authorities for opposition to a proposed route for a 275 kV line from Dungeness nuclear station across East Sussex to Shermanbury. The route is one already revised in accordance with a suggestion from East Sussex County Council after they had engaged a landscape consultant, but objectors say that the route passes so close to Haywards Heath that seen from the southern part of the town the 137 ft pylons would project above the skyline of the Downs. To the east, Battle RC have accepted part of the proposed route through their district and made suggestions for the remainder which involve several changes of direction.

At the annual dinner of the Bristol and District Branch of the Electrical Assen. for Women recently (reported above) left to right, Mr A. C. Thirtle, Miss M. George, Viscountess Kilmuir, Mrs A. N. Irens, Mr A. N. Irens, Mrs A. C. Thirtle.' (Picture by Photo Prints (Bristol) Ltd.)

Peebles licence with German firm

BRUCE Peebles and Co., of Edinburgh, have concluded an agreement with REGA Brucker and Co., of Germany, for the joint production and marketing of electrical equipment for the operation and control of rolling mills. Under a combination of resources, Bruce Peebles will have a franchise in UK and Eire and will themselves build rotating machines and rectifiers, while the electronics controls, programming, optimisation and automatic gauge control equipment will be designed by REGA Brucker and manufactured by either company.

LIGHTING EXHIBITION AT HARROGATE

THE DLMA announce that nine of their members have combined to hold an exhibition of new autumn lighting equipment at the Old Swan Hotel, Harrogate, from 29 May to 1 June. This is the first serious attempt to establish a basis for a Lighting Fair which it is hoped will develop into an annual event. Further details may be obtained from the Association at 69 Cannon St, London, E.C.4.

SCOTTISH INQUIRY INVITES EVIDENCE

THE Departmental Committee inquiring into power supply in Scotland held their first meeting in Edinburgh last Thursday and decided to invite written evidence from anyone interested. The evidence, to be sent to the secretary, Mr J. E. Stark, Room 433, St. Andrew's Hse, Edinburgh, should relate to the committee's terms of reference; these are to review generation and distribution in Scotland having regard to the availability and cost of hydro power and other sources, the rate of increase in demand, and the needs of the remoter areas.

Interest in Scotland is widespread. Fishing and amenity bodies have been loud in their opposition to a proposed hydro scheme at Glen Nevis, while Scottish Aims of Industry, the main protagonist in obtaining an inquiry, contends that other sources of power would be cheaper. On the other side of the fence, the Crofters and Smallholders' Assen. stands firmly behind the Hydro Board.

Proceedings will be in private throughout the inquiry, which is expected to take until the end of this year, but oral evidence may be invited at a later stage.

Appliance Sales Disappointing

SALES of appliances in February failed to match fully the recovery apparent in January, judging by figures released by the BoT. Radio/electrical, radio/cycle and electricity/gas showrooms, sold 9% less in February than in the corresponding month of the previous year. This compares with a shortfall of 8% in January this year on the previous January's turnover. Buoyant sales by food and clothing shops helped to give the overall index a healthier hue, with the volume of trade about 2% higher in February than in the corresponding month a year earlier.

A clue to this situation is given in a further decline of £6 million in the nation's hire purchase debt. February was the first full month since the repayment period was extended, but there was no recovery in credit sales by household goods shops.

Underground contracts placed anew

REPORTS that Birmingham Railway Carriage and Wagon Co. were seeking release from a contract to supply London Transport with 450 underground cars because they could not meet delivery dates were confirmed on Monday. The official announcement says Birmingham Railway have been released and the order placed with Metropolitan-Cammell. The cars are for replacement of stock on the Central and Piccadilly lines and delivery will begin early in 1962.

Loco Paradox

THE diesel-electric locomotive which did not travel under its own steam has ended up at Olympia under police escort. The 1,000 h.p. locomotive was brought from English Electric's works at Darlington by road last week for the Engineering Marine Exhibition which opens on 20 April. It was decided that road haulage all the way was more convenient than handling the 72 ton locomotive from rail siding to exhibition hall. The journey took four days.

Sayings OF THE WEEK

"When there is the next Suez crisis, my block storage heater will still be giving out heat." . . . MR A. J. MARE, of Streetly, in a letter to the *Birmingham Post*.

"The Clean Air Act is going to make a tremendous impact on the electricity industry." . . . MR W. HUTTON, deputy chairman of South of Scotland E.B.

"It is sheer nonsense to argue that the Durham coalfield is unsuitable for a power station." . . . MR SAM WATSON, Durham miners' leader.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, April 11

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	229½	+3½
„ (3 months)	230½	+2½
LEAD, refined pig, 99·97% purity (cash)	67½	+1½
„ (3 months)	68½	+1½
TIN, refined, min. 99·75% purity (settlement)	835	+10½
(3 months)	839	+12
ALUMINIUM, ingots 99·99·5% ...	186	—
„ wire bars (4×4×54")	193½	—
BRASS Strip 63/37	201½	+3½
SILVER (Troy oz)	79⅝d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	84½	+½
„ (3 months)	84½	+½
RUBBER, per lb.		
No. 1, RSS, spot	26½d	+1½d
c.i.f. basis, ports, June ...	25½d	+1d
ARMOURING:		
Galv. Steel Wire (0·104 in.) ...	66½	—
Mild Steel Tape (0·04 in.) ...	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	68	−1
AMERICAN PRICES:		
Copper, electrolytic (per lb) ...	29c	—
Lead, (New York)	11c	—

* *Tape Price, now an average, includes varnishing*

LARGE EXPORT ORDERS

SEVERAL large export orders were reported by British firms during the past week. **Mitchell Engineering,** which has already installed two 100 MW boilers at Komati station, Eastern Transvaal, has received a £2¼ million order for two more boilers for this station. The new boilers, due to be commissioned in 1964, will be the largest in the Union. Arrangements are being made for 80% of the plant to be made in South Africa through the Johannesburg associate, Mitchell Engineering Pty.

BICC is to supply cables and accessories for a second paper machine being installed at Tasman Pulp and Paper Co.'s mill in New Zealand. In 1956, BICC supplied 20 miles of various cables for this mill.

GEC have received an order exceeding £150,000 from Anglo-American Corporation for two double-drum winding engines to be installed 1,150 ft below the surface at Bancroft mine, Northern Rhodesia. One winder will be used for rock and the other for men and materials. Each drum will be 11 ft in diameter and 4 ft wide, and driven through single-reduction gears by 11 kV three-phase 1,440 h.p. 570 rev/min motors. Design and manufacture of the electrical equipment will be carried out at Witton Works.

AEI are supplying the complete electrical equipment for a new cotton mill in the Philippines. One order, worth £70,000, received by the Motor and Control Gear Division, includes automatic power factor correction control equipment and capacitors, switchgear, transformers, fluorescent lighting, control gear, cabling, and a 600 kVA a.c. generator for use with a diesel engine.

Brook Motors have received orders from a number of countries, including 75 motors of 5 h.p. to 250 h.p., worth £10,000, for a paper mill in Holland, and an order for 1,000 dish-washing machine motors for West Germany. These dish-washing motors are manufactured in the new extension at Barnsley.

Gas lamps hard to get

RESIDENTS of Ditchling, Sussex, are reluctant to change to electric street lighting, but attempts to obtain gas lantern replacements are proving of no avail. SE Gas Board was unable to help. A request for an estimate of the cost of a changeover has gone to Seeboard. Another Sussex village, Ferring, has voted against having its streets lit at all, by a 583 to 208 majority.

News in Brief

EMI Electronics Ltd. are to supply all the transmitting equipment for a television centre to be built at Kaduna, Northern Nigeria, EMI will also be a partner in the operating company.

Signs on pylons to indicate routes to ramblers have been permitted by MEB.

MoP consent to convert the remaining 21,000 non-standard supplies in Southport over the next four years is being sought by MANWEB.

AEI (Rugby) have issued a booklet giving details of the group's graduate training schemes in fields such as electronics, heavy plant and lighting.

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Elsewhere, Decca Record came in for some strong support, so that the Ordinary shares spun up from 69s 6d to 73s 9d and the "A" from 65s 6d to 69s 6d. EMI were also favoured—30% of the shares are now held by Americans—and rode up from 49s 6d to 50s 3d. Hoover's shares seem now to be reflecting the success with which their new products have met so that the "A" Ordinary shares climbed from 47s 6d to 52s 3d.

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Expansion to meet a high level of orders is the keynote of the current year. A new factory has been occupied at Holyhead and the main works at Tyseley are being extended. Raw material stocks are higher in expectation of greater output. Last year, increased turnover enabled trading profit to be held at £493,028 (previously £495,362), despite reduced prices and higher wages. Dividend was again 12%.

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Dividend is raised from 5% to 6%, while trading profit is steady at £65,667 (£65,691 in 1959). A satisfactory lengthening in the order book towards the end of 1960 has since been maintained.

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J. and F. Stone Lighting and Radio. Interim 12½% (*same*).

Strand Electric. Interim 8% (last year equivalent 4½%). Directors forecast a final 12% (last year 10%).

Appliance Sales Disappointing

SALES of appliances in February failed to match fully the recovery apparent in January, judging by figures released by the BoT. Radio/electrical, radio/cycle and electricity/gas showrooms, sold 9% less in February than in the corresponding month of the previous year. This compares with a shortfall of 8% in January this year on the previous January's turnover. Buoyant sales by food and clothing shops helped to give the overall index a healthier hue, with the volume of trade about 2% higher in February than in the corresponding month a year earlier.

A clue to this situation is given in a further decline of £6 million in the nation's hire purchase debt. February was the first full month since the repayment period was extended, but there was no recovery in credit sales by household goods shops.

Underground contracts placed anew

REPORTS that Birmingham Railway Carriage and Wagon Co. were seeking release from a contract to supply London Transport with 450 underground cars because they could not meet delivery dates were confirmed on Monday. The official announcement says Birmingham Railway have been released and the order placed with Metropolitan-Cammell. The cars are for replacement of stock on the Central and Piccadilly lines and delivery will begin early in 1962.

Loco Paradox

THE diesel-electric locomotive which did not travel under its own steam has ended up at Olympia under police escort. The 1,000 h.p. locomotive was brought from English Electric's works at Darlington by road last week for the Engineering Marine Exhibition which opens on 20 April. It was decided that road haulage all the way was more convenient than handling the 72 ton locomotive from rail siding to exhibition hall. The journey took four days.

Sayings OF THE WEEK

"When there is the next Suez crisis, my block storage heater will still be giving out heat." . . . MR A. J. MARE, of Streetly, in a letter to the *Birmingham Post*.

"The Clean Air Act is going to make a tremendous impact on the electricity industry." . . . MR W. HUTTON, deputy chairman of South of Scotland E.B.

"It is sheer nonsense to argue that the Durham coalfield is unsuitable for a power station." . . . MR SAM WATSON, Durham miners' leader.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, April 11

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	229½	+3½
" (3 months)	230½	+2½
LEAD, refined pig, 99·97% purity (cash)	67½	+1½
" (3 months)	68½	+1½
TIN, refined, min. 99·75% purity (settlement)	835	+10½
(3 months)	839	+12
ALUMINIUM, ingots 99·99·5% ...	186	—
" wire bars (4×4×54")	193½	—
BRASS Strip 63/37	201½	+3½
SILVER (Troy oz)	79⅛d	—
ZINC, virgin, min. 98% purity (cash)	84½	+½
" (3 months)...	84½	+½
RUBBER, per lb. No. 1, RSS. spot	26½d	+1½d
c.i.f. basis, ports, June ...	25½d	+1d
ARMOURING: Galv. Steel Wire (0·104 in.) ...	66½	—
Mild Steel Tape (0·04 in.) ...	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	68	−1
AMERICAN PRICES: Copper, electrolytic (per lb) ...	29c	—
Lead. (New York)	11c	—

* *Tape Price, now an average, includes varnishing*

LARGE EXPORT ORDERS

SEVERAL large export orders were reported by British firms during the past week. **Mitchell Engineering,** which has already installed two 100 MW boilers at Komati station, Eastern Transvaal, has received a £2¼ million order for two more boilers for this station. The new boilers, due to be commissioned in 1964, will be the largest in the Union. Arrangements are being made for 80% of the plant to be made in South Africa through the Johannesburg associate, Mitchell Engineering Pty.

BICC is to supply cables and accessories for a second paper machine being installed at Tasman Pulp and Paper Co.'s mill in New Zealand. In 1956, BICC supplied 20 miles of various cables for this mill.

GEC have received an order exceeding £150,000 from Anglo-American Corporation for two double-drum winding engines to be installed 1,150 ft below the surface at Bancroft mine, Northern Rhodesia. One winder will be used for rock and the other for men and materials. Each drum will be 11 ft in diameter and 4 ft wide, and driven through single-reduction gears by 11 kV three-phase 1,440 h.p. 570 rev/min motors. Design and manufacture of the electrical equipment will be carried out at Witton Works.

AEI are supplying the complete electrical equipment for a new cotton mill in the Philippines. One order, worth £70,000, received by the Motor and Control Gear Division, includes automatic power factor correction control equipment and capacitors, switchgear, transformers, fluorescent lighting, control gear, cabling, and a 600 kVA a.c. generator for use with a diesel engine.

Brook Motors have received orders from a number of countries, including 75 motors of 5 h.p. to 250 h.p., worth £10,000, for a paper mill in Holland, and an order for 1,000 dish-washing machine motors for West Germany. These dish-washing motors are manufactured in the new extension at Barnsley.

Gas lamps hard to get

RESIDENTS of Ditchling, Sussex, are reluctant to change to electric street lighting, but attempts to obtain gas lantern replacements are proving of no avail. SE Gas Board was unable to help. A request for an estimate of the cost of a changeover has gone to Seeboard. Another Sussex village, Ferring, has voted against having its streets lit at all, by a 583 to 208 majority.

News in Brief

EMI Electronics Ltd. are to supply all the transmitting equipment for a television centre to be built at Kaduna, Northern Nigeria. EMI will also be a partner in the operating company.

Signs on pylons to indicate routes to ramblers have been permitted by MEB.

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OVERSEAS NEWS

from our correspondents abroad

CANADA

BC Premier's Surprise Move

Following an earlier sensation last month, when BC Premier Bennett said his Government may have to take over the £220 million British Columbia Electric Co., he caused further surprise recently by accepting an opposition resolution which proposes a study of the company with a view to possible public ownership. The Province already owns the British Columbia Hydro Commission, who would almost certainly be responsible for the Columbia River development. Ownership of BCE would not only give the Government almost power monopoly, it would also enable them to increase their share of the company's tax payments now made to the Federal Government. Two other companies, the West and East Kootenay Power companies, with assets placed at $28 million, would also be involved in any study.

Shawinigan to Spend $25 Million

Major part of the Shawinigan Water and Power Co.'s expenditure this year will be on a 345 kV transmission line from Lake St. John to Quebec. The company also announce that work will begin this year on a 125 MW hydro-electric station on the St. Maurice River. The station will be at Rapide des Coeurs and is expected to cost $44 million. It is planned for completion in 1964. In addition, the company has projected a thermal station to burn residual oil and to work in conjunction with the Rapide des Coeurs hydro plant.

Power Export Application

The first major application for long-term power export has been lodged with the National Energy Board by BC Electric. The application is for permission to export up to 324 MW for a period of 25 years. If the application is granted, it is expected to establish the principle of long-term power exports. The company has in the past been exporting and importing power to the Northwest Power Pool for a number of years on a year-to-year licence basis.

Calgary Power Maintain Demand

During 1960, the demand for electricity services remained strong for Calgary Power, but a lower rate of expansion is anticipated for future years. During 1960, the company spent $12 million on expansion of generating plant and facilities bringing the total investment to about $144 million. Extensions to the Spray and Rundle plants, completed in 1960, have brought the hydro generating capacity to more than 650,000 h.p. These two plants and eight others, also on the Bow River, are remotely controlled from a single control centre at Seebe. Construction began during the year on the 200,000 h.p. Wabamum steam station; and the Brazeau River site, later to have hydro-electric plant, was in the initial development stages. The company now operates 8,400 miles of transmission and distribution lines. 70% of the 85% of Alberta's farms electrified are supplied by the company.

Support for Manufacture Minister

In a letter to the Prime Minister, the Canadian Lamp and Fixture Manufacturers' Association has proposed that the federal Government should have a department of manufacture. A manufacturing executive as Minister, they say, should have a staff to promote sales and secure most efficient operation of Canadian plants. This suggestion was also put forward earlier by CEMA as reported in the ELECTRICAL TIMES for 23 Feb., 1961.

U.S.A.

Outsize Nuclear Plant

Construction of a 700 MW nuclear power station, claimed to be the largest in the world, is planned. The station is to be at Hanford in Washington State.

W. INDIES

Difficult Year in Bahamas

Caught between the effects of rising electricity demand, shortage of generation plant and a series of mechanical breakdowns in existing plant, the report of the Bahamas Electricity Corporation for the year ending 30 Sept., 1960, says the year's operations were the most difficult on record. Owing to severe shortage of generating plant, it was necessary on many occasions to interrupt supply to consumers. Units generated during the year rose by 20·5% to 73·8 million kWh and the maximum demand was 12·6 MW. It is of interest that the effect of air conditioning installations has been to put back the annual peak from March to August, while improving the loan factor to 67·2%. The corporation now has 20·2 MW of generating plant and during the year they increased their number of consumers by 10·8%. Income from sales was 18·1% higher than in the previous year at £718,748 and the year showed a working surplus of £42,923. It was possible to reduce the price of electricity by 0·064d/unit to 2·802d/unit. Expenditure was 16·6% higher than in 1959 at £648,523. During the year two main 33 kV transmission lines were completed and placed in service with their associated transformers and switchgear. The report states that progress on the Clifton Pier power station was extremely disappointing. Output for the No. 1 set was restricted to 1 MW instead of its rating of 6·1 MW because of difficulties with the sea water evaporating unit. At one time, the corporation even had to appeal to members of the public to make rain water available for boiler feed. The No. 2, 5 MW machine, was run for the first time in September. Particularly unfortunate were crankshaft troubles which put out of action three of the corporation's diesel sets during the year.

St. Lucia Takeover

Plans for the takeover of the St. Lucia electricity services by the Colonial Development Corporation have been accepted in principle by the Territory's Government. The venture, in which the St. Lucia Government and the Castries town council will participate is now receiving detailed attention.

BRITISH GUIANA

15 MW Station Commissioned

The 15 MW oil-fired station of the Demerara Bauxite Co. is now in commission. The station, with two 7·5 MW turbine-generators, has electrical plant manufactured in the United Kingdom. In addition to supplying electricity and process steam to the bauxite plant, the station will also provide power for the township of Mackenzie through an overhead line.

S. AFRICA

Komati Station Boilers

An order for the supply and erection of two boilers at the new extensions to Komati power station, valued at approximately £2¼ million, has been awarded to Mitchell Eng., through their associate in South Africa. The boilers will be the largest installed in the Union and are scheduled for completion in 1964. Arrangements have been made for about 80% of the plant to be manufactured in South Africa. Last week, we reported that the order for the turbo-generator plant for this station had been awarded to AEI.

UGANDA

Transmission System Loan

A loan equivalent to $8·4 million has been made to Uganda by the World Bank for extension of transmission and distribution facilities. Most of Uganda's power comes from the 120 MW Owen Falls hydro-electric station, but because industrial development has not been as rapid as was anticipated, at present only half the capacity of the station is being used. Uganda's Electricity Board intends to widen their power market over the period 1959 to 1963 by constructing

transmission lines to Gulu, north of Lake Kyoga, Hoima, Masindi and Fort Portal. Extension of the system will enable power to be supplied for the first time to several small towns on route, tea estates, factories and also to the Kilemba copper mines. A small hydro-electric station is also to be built at Kabale. The total cost of the extensions is estimated at $14 million and will partly be open to overseas tenders.

INDIA

Delhi Plant Short of Water

A barrage was erected recently to divert waters of the River Jamuna to the Delhi central power house following a decline in the river flow. The station supplies about 40 MW to the city, but power cuts might have been necessary if dredging and construction operations were not successful in increasing the water available at the station intakes. The original barrages erected were destroyed by floods in 1956 and have not since been replaced.

Gujarat Third Plan Allotment

Provision of Rs7 crore by the Gujarat EB covers the first year's schemes under the Third Plan. The total provision for power development in the State under the plan is Rs42·98 crore.

Midget Hydro Stations

Small hydro power stations utilising the low heads available on the Godavari and Krishna canals will be constructed under the Third Plan at a cost of Rs20 lakh. The equipment will be built in India. Recently the Public Works Minister said that by 1966 the Andhra Pradesh State would have an integrated power system linking all the major hydro and thermal stations. So far less than 5% of the State's hydro resources had been exploited, he said, and coal reserves as yet untapped were estimated at 4,000 million tons. A committee is shortly to be set up by the State Government to investigate the high cost of electricity generation.

SARAWAK

Expansion Maintained

For the year ending June, 1960, generation by the Sarawak Electricity Supply Co., which is wholly owned by the Sarawak Government, was 14·6 million units or 11·8% more than in the previous year. Over the past ten years, consumption of electricity has risen by an average of 18% per year and last year the maximum demand was nearly 5 MW. Since the undertaking was taken over by the Government in 1953, the company's reserves and issued capital have risen to $11,670,935. Last year, income from electricity sales rose by 14·6%. The 16 generating stations owned by the company have a total installed capacity of 9·25 MW, of which more than half is at Kuching. During the year the company introduced a hire-purchase and assisted wiring scheme to help consumers and efforts have been made to reduce tariffs. Consideration is now being given to a special tariff to attract the larger industrial consumers. It is also proposed to conduct a survey of hydro power resources in Sarawak. Several extensions to the distribution system are planned including undergrounding of all cables in the centre of Kuching.

MALAYA

Cameron Highlands Scheme

Mechanical and electrical plant for a hydro-electric plant at Habu, will be erected and supplied by Humphrey and Glasgow. The contract for the plant has been placed with the company by the Central Electricity Board of the Federation of Malaya, whose consultants are Messrs Preece, Cardew and Rider. As reported in the ELECTRICAL TIMES, for 30 March, the turbines are to be constructed by Gilbert, Gilkes and Gordon. The alternators will be built by Tecnomasio Italiano Brown Boveri of Italy. The scheme is expected to be completed in just over two years.

AUSTRALIA

Vales Point Boiler Drum Arrives

A boiler drum for the Vales Point power station recently arrived on site. Manufactured by International Combustion, the boiler will have a rating of 1,350 klb/hr at 2,700 lb/sq in. The Vales Point first 200 MW set is scheduled for commissioning in the winter of 1963. It will have a reheat cycle.

Black-outs Protest

The Southern Electricity Commission does not propose to build new power stations in Western Victoria despite a reported total of 61 black-outs in Warrnambool since 1953. This was stated by the chairman of the SEC recently at a protest meeting in the town. In answer to speakers, Mr Connolly said there was no intention either to extend the present station to the original 20 MW design capacity, or to build a 100 MW station in Portland. He said, however, that the SEC might consider later a ring-main connection between Hamilton and Portland.

Hydro Scheme Officially Opened

The Governor of Tasmania, Lord Rowallan, opened the Lake Echo, Liapootah and Wayatinah hydro-electric stations at a recent ceremony. These three stations have a combined output of 154 MW. Wayatinah is at present the lowest of the chain of stations on the River Derwent.

The Canadian Red Rock 40 MW station of Ontario Hydro, on the Mississagi River, was completed towards the end of last year. The station is about 50 miles east of Sault Ste Marie and will be controlled from George W. Rayner station about 15 miles away. The main dam is 952 ft long and 95 ft high. A feature of the station is the installation of electro-hydraulic governors. Red Rock will form one unit of a four station block feeding into a 460 kV transmission line. Central control will enable turbine gates of the individual station units to be operated in unison. The electro-hydraulic governors used are said to have no dead band or mechanical friction. They use a magnetic amplifier operating in conjunction with a transducer and hydraulic servomotor for operating the valves

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

13 April—Dublin Health Authority. Supply and installation of 50 kW electrode boiler and switchgear at Turvey Farm, St. Ita's Hospital, Portrane. Secretary, St. Brendan's Hospital, Dublin 7.

14 April—Belfast C.C. Electrical installation Falls Rd library.—See 6 April issue.

14 April—Cardiff C.C. Installation of seven-person passenger lift at Fairwater Hse, Fairwater Rd.—See 6 April issue.

14 April—Larne. (c) Electrical work in site distribution services at Moyle Hospital. Applications to Secretary, N.I. Hospitals Authority, 27 Adelaide St, Belfast 2, by above date.

14 April—Letchworth U.D.C. Removal/resiting and conversion of 93 steel columns and erection of 41 Group "A"/104 Group "B" concrete columns and 16 steel Group "B" columns, together with the installation of lanterns/gear.—See 30 March issue.

14 April—Morley B.C. 27 140 W sodium units on 25 ft concrete columns.—Advertised 16 March issue.

14 April—Pocklington R.D.C. Duplicate 85 g.p.m. sewage pumps and an 80 g.p.m. sludge pump, together with motors.—See 30 March issue.

14 April—Redcar B.C. Erection of street lighting.—See 6 April issue.

15 April—Belfast. (c) Electrical services installation at Belfast City Hospital Blood Transfusion Service. Applications to Secretary, N.I. Hospitals Authority, 27 Adelaide St, Belfast 2, by above date.

15 April—Chapel-en-le-Frith R.D.C. Electrical installation in eight houses.—See 30 March issue.

15 April—Coleraine R.D.C. Electrical installations in 22 dwellings.—See 30 March issue.

15 April—Girvan B.C. Electrical work in new sports pavilion, Victory Park. Applications to Town Clerk: J. H. Cunningham, by above date.

17 April—Cardiff C.C. Erection of 1,830 Class "B" concrete columns complete with fluorescent lanterns and gear. City Surveyor, City Hall. Deposit £2 2s, payable to Corpn.

17 April—Flintshire C.C. Provision and erection of: distribution; pillar; eight 30 ft columns; 200 W sodium lanterns; four fluorescent units for advance direction signs; and wiring, including 12 "Keep Left" bollards.—Advertised 23 March issue.

17 April—Newcastle upon Tyne C.C. One 40-ton, two ten-ton and two six-ton travelling cranes.—See 30 March issue.

17 April—Port Talbot B.C. 36 35 ft steel columns with double outreach; ten 35 ft columns with single outreach; 35 200 W sodium lanterns; 18 "Keep Left" bollards; 2,300 yd cable, traffic signs, etc., for Talbot By-Pass lighting.—See 23 March issue.

17 April—West Riding C.C. (a) Provision of motorway signs and fixing/wiring of sign lighting; (b) provision of 80 W fluorescent floodlighting lanterns, also 8 W and twin 6 W lighting.—See 30 March issue.

18 April—Bury C.B.C. 61 30 ft steel or concrete columns and 200 W sodium lanterns, lamps, gear and time switches; (b) erection; (c) removal of 120 existing standards.—Advertised 6 April issue.

18 April—Dewsbury C.B.C. Renewal of general o/h lighting in covered market. Architect and Bldgs Surveyor, Town Hall.

18 April—Maidstone B.C. Supply and erection of: 83 25 ft steel columns; 103 Group "A" fluorescent lanterns; 49 20 ft steel columns; 49 intermediate fluorescent lanterns; 165 15 ft steel columns and Group "B" fluorescent lanterns.—See 6 April issue.

18 April—Sunderland C.B.C. Electrical installations in 305 dwellings, Town End Farm estate.—Advertised 30 March issue.

18 April—West Riding C.C. Electrical installation in Gomersal C.E. School.—See 23 March issue.

19 April—Athy U.D.C. Duplicate 14,000 g.p.h. water pumps.—See 16 March issue.

20 April—Wallasey C.B.C. Electrical installations in 46 maisonnettes, Mersey St area.—Advertised 30 March issue.

21 April—Bath C.C. Electrical installations in 94 dwellings and one laundry at Snow Hill. Applications, by contractors on N.I.C.E.I.C. roll, to architects: Snailum and Le Fevre, 18 Brock St, Bath, by above date. Deposit £1 1s.

21 April—Bedlingtonshire U.D.C. Supply: electrical goods, cookers and boilers.—See 16 March issue.

21 Aoril—Larne B.C. Electrical installation in Municipal Offices.—See 30 March issue.

22 April—Littleborough U.D.C. Supply of 24 concrete Group "B" columns and 60 W sodium lanterns, lamps and gear. Engineer and Surveyor, Council Offices.

24 April—Blackpool C.B.C. Supply: 120 Group "B" columns, fluorescent lanterns and brackets; 150 time switches; 30 Group "A" columns/brackets and fluorescent lanterns.—Advertised 6 April issue.

24 April—King's Lynn B.C. Centrifugal pumps and ancillary equipment for Dock Outfall Station.—See 6 April issue.

24 April—Morpeth B.C. (3) Electrical installations in 89 houses, Spelvit La. Borough Surveyor: F. K. Perkins, 36 Bridge St.

24 April—Rhondda B.C. Group "A" sodium lighting on pre-stressed spun concrete and steel columns along 10½ miles of classified roads.—Advertised 30 March issue.

25 April—Bury C.B.C. Supply of sodium, fluorescent and tungsten lamps for 1961-62. Street Lighting Superintendent, Hacking St.—Advertised in this issue.

27 April—Cardiff C.C. Electrical installation, on fixed-price basis, in Fairwater County Primary School, Pentrebane Rd. Details from W. S. Atkins and Ptnrs., 6 Park Pl, Cardiff. Deposit £2 2s, payable to Corpn.

27 April—Dublin Health Authority. Electrical installation in boiler house, St. Ita's Hospital, Portrane. Details from consulting engineers: J. A. Kenny and Ptnrs., 44 Kildare St, Dublin. Deposit £5 5s.

27 April—Scunthorpe B.C. Rewiring of 238 pre-war houses, Crosby estate. Housing Manager, Lincoln Gdns.—Advertised in this issue.

29 April—Otley U.D.C. 50 Group "A" tubular steel columns/brackets, lanterns, lamps, gear and wiring of 250 W and 400 W colour-corrected mercury lighting along 1·069 mile Pool Rd, A659.—Advertised 6 April issue.

29 April—Staffordshire C.C. Supply of (a) demonstration equipment for electrical laboratory; (b) chemical laboratory major equipment; and (c) X-ray apparatus for nucleonic block.—Advertised 23 March issue.

29 April—Staffordshire C.C. Supply: batteries and battery chargers.—Advertised 30 March issue.

1 May—Ipswich C.B.C. Electrical installation in St. Mathew's Baths.—Advertised 30 March issue.

1 May—Lurgan. Electrical wiring and heating installation in new church hall at Shankhill Parish Church. Details from architects: T. T. Houston and Ptners, 26 College Gdns, Belfast 9. Deposit £3 3s.

1 May—Westmeath C.C. Electrical installation in sanitary annexes at St. Mary's Hospital, Mullingar. Details from consulting engineer: J. C. Costello, 21 Leeson Park, Dublin. Deposit £5.

1 May—Worksop R.D.C. Duplicate 150 g.p.m. sewage pumps complete with motors, starters and accessories.—See 6 April issue.

2 May—Newry No. 2 R.D.C. Duplicate 25 g.p.m. at 335 ft head pumps for Tullymacreeve Booster Station.—See 30 March issue.

2 May—West Riding C.C. (4) Part rewiring of Horsforth Springfield Special School; (6) lighting improvements at Bingley Secondary School; (7) rewiring of Swinton Bridge Junior Mixed and Infants' School; (9) rewiring of Featherstone George St School; (10) rewiring of Pontefract C.E. Girls' School. Details from (Contracts 4 and 6) Divisional Architect, Salisbury Bldgs, Albert St, Harrogate; (Contract 7) Divisional Architect, Planet Rd, Adwick-le-Street; (Contracts 9 and 10) Divisional Architect, Bishopgarth, Westfield Rd, Wakefield. Applications to quote N.I.C.E.I.C. roll number.

3 May—Manchester C.C. Supply and installation of (a) two passenger/goods lifts at Central Technical College; (b) two passenger lifts; and (c) electrical engineering services at Elizabeth Gaskell College Hostel. City Architect, P.O. Box 488, Town Hall.

4 May—Belfast C.C. (a) Electrical installation in Tower St Institute for Further Education.—See 6 April issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 116 queries answered this week

"Elco" soldering irons—address for spares? D.B.—Elcordia Ltd., 225 Westminster Bridge Rd, S.E.1.

"Flambosign" directional signs—suppliers of? G.H.—Electrical Dept., Maple and Co. Ltd., 149 Tottenham Court Rd, W.1.

"Columbine" vacuum cleaners—makers of? Y.E.B.—C.V.A. Jigs, Moulds and Tools Ltd., 329 Portland Rd, Hove 3, Sussex.

"Minirupteur" neoprene-clad industrial circuit-breakers—agents for? J.A.E.—A.F.S. Developments, 1026 Harrow Rd, N.W.10.

"Trinidite" jointing compound—makers of? T.E.—Dussek Bitumen and Taroleum Ltd., Loushers La, Wilderspool, Warrington, Lancs.

"Marvel" switches—makers of? P.L.—Simplex Electric Co. Ltd., Broadwell, Oldbury, Birmingham.

"Edy" washing machines—address for? L.E.B.—Edy (Great Britain) Ltd., Farnley Low Mills, Wortley, Leeds 12.

Rigid p.v.c. channelling for house wiring protection—makers of? E.E.W.—Ega Developments Ltd., Holyhead Rd, Wednesbury, Staffs.

"Kleenway" garbage disposal units—suppliers of? D.F.L.—Proops Brothers Ltd., 52 Tottenham Court Rd, W.1.

FURTHER ANSWER

"Ohmic" lamps—makers of? E.D.A.—This trade mark has been acquired by: Luxram Electric Ltd., 72 Gt. Eastern St, E.C.2.

Something you know from experience...

A reputation for quality products is not won easily. It is something to be jealously guarded.
This is one of the reasons why Switch Fuse Control Units by Wylex offer special features in their design and materials.
Features like the easily accessible terminals, ample wiring room, domed end screws . . .
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Switch Fuse Control Units

WYLEX

AND COOKER UNITS, SWITCHED SPUR BOXES, SWITCHES, PLUGS AND SOCKETS

GEORGE H. SCHOLES & CO., LTD., Wylex Works, Wythenshawe, Manchester 22.

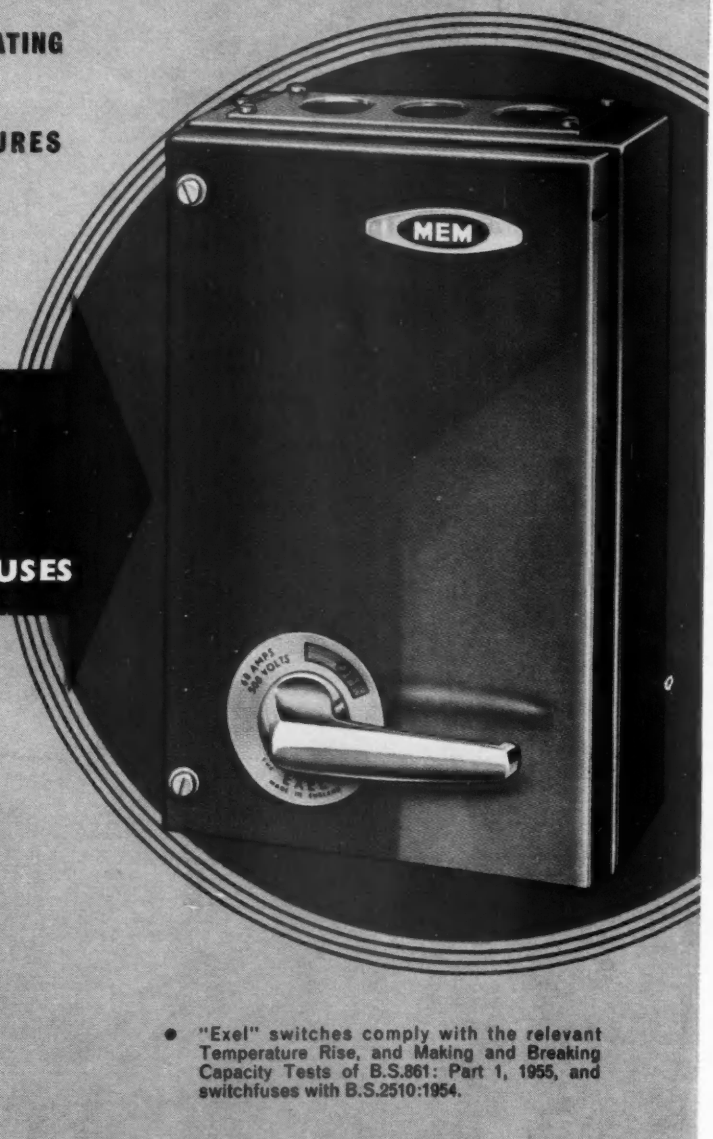
MEM introduce a new range of 500 volt SWITCHGEAR

CHROME PLATED FRONT OPERATING SWITCH HANDLES

FABRICATED STEEL ENCLOSURES

SEMI-ENCLOSED REWIRABLE OR H.R.C. CARTRIDGE FUSES

15, 30, 60, 100 AMPS



'EXEL'

SWITCHES AND SWITCHFUSES

- Fabricated cases are of heavy gauge sheet steel with hinged covers, rustproofed and finished grey stove enamel.
- The "Exel" range is fitted with chrome plated front operating switch handles, a feature which permits more compact assemblies on switchboards or panels.
- The "ON" and "OFF" positions are clearly shown by an indicator associated with the switch handle.
- Fuse bases are of the new "Kantark-Exel" pattern, which will accept semi-enclosed rewirable or H.R.C. cartridge fuse carriers.
- M.E.M. H.R.C. cartridge fuse carriers are designed to accommodate H.R.C. cartridge fuse-links to B.S.88:1952, Appendix 'J' Dimensions, Form A—Offset Tags.
- M.E.M. H.R.C. cartridge fuse-links are available for use with this range of switchgear, and have been A.S.T.A. certified for Category of Duty 440 AC3 (16,500 amps), 440 AC4 (33,000 amps) and 440 AC5 (46,000 amps).
- "Exel" switches comply with the relevant Temperature Rise, and Making and Breaking Capacity Tests of B.S.861: Part 1, 1955, and switchfuses with B.S.2510:1954.

. . . and so many other features, too

Write for M.E.M. List No. 450

MEM

MIDLAND ELECTRIC MANUFACTURING CO. LTD., REDDINGS LANE, TYSELEY, BIRMINGHAM 11

4 May—Northwich R.D.C. Electrical installations in eight dwellings off Grange Rd, Cuddington, and 28 dwellings off Wessex Drive, Rudheath. Engineer and Surveyor, Whitehall, Hartford, Northwich. Deposit £1 1s.

5 May—Tyrone C.C. Electrical installation in new county H.Q.—See 6 April issue.

9 May—Athlone U.D.C. Duplicate 52,000 g.p.h. at 40 ft head pumps.—See 6 April issue.

9 May—Hebburn U.D.C. (2) Electrical installations in 24 flats and 24 maisonnettes in three three-storey blocks being built by direct labour. Engineer and Surveyor, Argyle St. Deposit £3 3s.

9 May—Willesden B.C. (a) Supply of 15 140 W and 261 60 W sodium lighting units/gear; (b) supply and erection of 15 25 ft concrete columns and 261 15 ft columns, wiring and fixing of lanterns/gear. Borough Engineer and Surveyor, Town Hall, Dyne Rd, N.W.6. Deposit £2 2s.

15 May—Chester C.C. Supply of lamps for 11 months. Town Clerk: G. Burkinshaw, Town Hall.

15 May—Newcastle upon Tyne C.C. Electrical installation, baths and laundry, Montagu estate.—See 16 March issue.

12 June—E.B. for N. Ireland. Two 25,000 g.p.m. circulating water pumps and non-return valves for Coolkeeragh.—See 6 April issue.

No date stated—Bristol C.C. Electrical work in boiler and heating installation, College of Commerce.—See 23 March issue.

No date stated—N. of Scotland H.E.B. Construction of 54 mile 275 kV double circuit transmission line between Cruachan and Windyhill. Details from engineers: Merz and McLellan, 72a George St, Edinburgh 2. Deposit £2 2s. Advertised in this issue.

No date stated—Sheffield C.C. Waterworks. Supply and installation of 11/3·3 kV and 3·3 kV/415 V transformers, 3·3 kV air break switches, 3·3 kV contactor starters, etc., for Yorks Derwent Scheme.—Advertised 30 March issue.

No date stated—Southport Hospital Committee. Applications for inclusion in list for electrical maintenance work to Group Secretary, Promenade Hospital, Southport.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

18 April—America. 13·2 kV shunt reactors, three of 4 MVA for Sioux City substation and six of 3,333 kVA for Denison substation. Dept. of the Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center. B.o.T. (ESB/11111/61).

18 April—S. Africa. 25 11 kV t.p. oil-immersed, four-way isolator units. Town Clerk, City Hall, Pretorous Sq, Pretoria. B.o.T. (ESB/11161/61).

19 April—Nigeria. Combination kVA m.d./kWh meters and one three/four panel h.t. switchboard. Secretary, E.C. of Nigeria, Private Mail Bag 2030, Lagos. B.o.T. (ESB/11490 and 1/61).*

21 April—India. 140 metric tons copper wire and strip. Trade Agent for Mysore in London, 28 Cockspur St, S.W.1. B.o.T. (ESB/11728/61).*

24 April—S. Africa. 35,200 yd rural distribution cable. Secretary, Union Tender Board, 291 Bosman St, Pretoria. B.o.T. (ESB/10834/61).

25 April—America. One 15 MVA 3-ph. power transformer. Dept. of the Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center. B.o.T. (ESB/11193/61).

26 April—America. One main duplex control board and one carrier-current transmitter/receiver set. Dept. of the Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center. B.o.T. (ESB/11436/61).

26 April—India. Switchgear for use with 3 MW set at Masuria Power Station. Superintending Engineer (Procurement), Rajasthan State E.B., Jaipur. B.o.T. (ESB/11406/61).

26 April—India. 500 tons bare h.d. copper conductor 8 s.w.g. Chief Engineer (South), Stores Purchase Section, The Mall, Patiala. B.o.T. (ESB/11199/61).*

26 April—Pakistan. Underground cable and insulated wire (eight items). Director-General of Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/10899/61).

26 April—South Vietnam. Glass h.t. insulators (three items) for 7, 15 and 35 kV. Central Purchasing Authority, P.O. Box H.5, Saigon. B.o.T. (ESB/11151/61).

28 April—India. Control panels, etc., for Sharavathi Valley H.E. Project. Secretary, Stores Purchase Committee, Bangalore. B.o.T. (ESB/114444/61).

29 April—India. 9,200 250 W 32 V gas-filled lamps. Chief Controller of Purchase, P.W. Railway, Empress Rd, Lahore. B.o.T. (ESB/11851/61).*

3 May—Rhodesia and Nyasaland. Three 100 kVA and 42 200 kVA 11 kV/400 V transformers. Town Clerk, P.O. Box 591, Bulawayo. B.o.T. (ESB/11486/61).*

4 May—Australia. 11 kV 250 MVA switchgear for Lidcombe, Rose Bay, Mosman and Botany. General Manager, Sydney C.C., Box 4009, G.P.O., Sydney. B.o.T. (ESB/11843/61).*

10 May—Thailand. 365,000 lb all-aluminium conductor (three items). Metropolitan Electricity Authority (Wat Lieb). B.o.T. (ESB/11495/61).*

15 May—Australia. Eight motor/generator sets, control, contactor, battery charger, d.c. distribution and auxiliary transformer selection cubicles for Vales Point Power Station, Sydney N. substation, Waratah and Orange control centres. Manager and Secretary, E.C. of N.S.W., Box 5257, G.P.O., Sydney. B.o.T. (ESB/11842/61).*

15 May—Burma. E.L.C.B's, t.p., 250 of 15 A, 250 of 30 A and 125 of 60 A. Commercial Manager, Rangoon Electric Supply, 502 Merchant St. B.o.T. (ESB/11823/61).*

18 May—New Zealand. 60 toroidally wound 50 W, 2,500 ohm potentiometers. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/11155/61).

23 May—India. 310 400 V o.c.b's. Chief Engineer (South), Stores Purchase Section, The Mall, Patiala. B.o.T. (ESB/11197/61).*

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Astro. 797,120. Class 7. Generators, etc. Hawker Siddeley (Hamble) Ltd., South Wks, Hamble, Southampton.

"Babette." 812,101. Class 9. Sound amplifying and reproducing apparatus incorporating transistors for use as baby alarms. J.C. Acoustics, 61 Wolseley Rd, Wealdstone, Harrow.

Condulet. 812,279. Class 9. Conduit material. Crouse-Hinds Co., Wolf and Seventh North Sts, Syracuse, N.Y., U.S.A.

Conquest. 809,778. Class 7. Sewing machines. Home Sewing Machines Ltd., 761 High Rd, Seven Kings, Essex.

Emicord. 811,867. Class 9. Insulated flexibles, etc. Electric and Musical Industries Ltd., Blyth Rd, Hayes, Middx.

Filter Queen in design. B797,091. Class 9. Vacuum cleaners, etc. Health-Mor Inc., 203 North Wabash Ave, Chicago, U.S.A.

Flo-mel. 813,360. Class 7. Pumps for use in central heating systems. T. Eadington and Sons Ltd., BDA Mill, Dean Rd, Handforth, Ches.

Kerafar. 805,427. Class 9. Parts of apparatus. Steatit-Magnesia Aktiengesellschaft, Am Steg 14, Lauf (Pegnitz), Germany.

Micalastic. B807,168. Class 17. Insulating substances, etc. Siemens-Schuckertwerke Aktiengesellschaft, Werner-von-Siemens-Strasse 50, Erlangen, Germany.

NCS in design. 780,553. Class 9. Measuring instruments, etc. Nalder Bros. and Thompson Ltd., 97 Dalston La, E.8.

Newlec. 811,004. Class 11. All goods except refrigerators. Newey and Eyre Ltd., 102 Hagley Rd, Edgbaston, Birmingham 16.

Polaris. 807,548. Class 11. All goods. Thorn Electrical Industries Ltd., 105-109 Judd St, W.C.1.

Polymatic. 813,970. Class 7. Washing machines, drying machines, etc. Polymatic Domestic Appliances Ltd., Cater Bldgs, Cater St, Bradford 1.

Reverbersonic. 808,250. Class 9. Sound recording and reproducing apparatus, etc. Thorn Electrical Industries Ltd., 105-109 Judd St, W.C.1.

Texoflex. 812,257. Class 11. Lamp shades. Rotaflex (Gt. Britain) Ltd., 4-10 Nile St, N.1.

Transidex. 805,296. Class 7. A.C. generators, etc. W. H. Allen Sons and Co. Ltd., Queens Eng. Wks, Bedford.

Vyko. 814,076. Class 11. Heating elements in tape form, etc. Tannoid Ltd., Church Row Wks, Wandsworth Plain, S.W.18.

Whispair. 807,226. Class 11. Air-conditioning apparatus, etc. Temerature Ltd., Burlington Wks, Burlington Rd, S.W.6.

CONTRACTS PLACED

Bradford C.C. Rewiring of Town Hall, T. W. Broadbent Ltd., £27,827. Recommended.

Ealing B.C. Electrical installation renewal at Perivale Junior and Infants' Schools, Colwood Electrical Installations Ltd., £1,955. Recommended.

Luton B.C. Electrical installations in: School Clinic extensions, £1,839; 24 houses, Dellcot Close, £725. J. J. Burtenshaw Ptnrs. Ltd.

Manchester C.C. Electrical installations: Contract 242F, Langley estate, Bates Electrical Services; Contract 284A, Holland St, Miles Platting; and Contract 344, Mill St, Ancoats, G. W. Henry Ltd. Additional switchgear for main pumping station, Davyhulme Sewage Wks, Brush Electrical Eng. Co. Ltd.

Romford B.C. Provision of Colchester Rd lighting equipment, Atlas Lighting Ltd., £1,048. Recommended.

Smethwick B.C. Electric work in clinic, Stanhope Rd, Williams Bros. (Electrical) Ltd. Recommended.

South Shields T.C. Electrical installation in new Whiteleas Junior Mixed School, Gee and Brown Ltd., £3,617.

Stockport T.C. Electrical installation work at Victoria Pk (Contract 1), Piggott and Whitefield Ltd., £7,193.

Stourbridge B.C. Electrical installations in: 69 houses, Cemetery Rd, Gwilliam Bros., £1,082; 221 houses, Hugh Pk, T. R. Priest and Sons Ltd., £3,820; 117 houses, Hungary Hill, £1,812; and 85 houses, Stepping Stones, £1,336, Hill and Priest. Recommended.

West Hartlepool T.C. Supply of 165 street lighting columns, B. L. Oliver.

TRADE NOTES

Changes of Address. The Cressall Manufacturing Co. Ltd. has moved to 59 Cheston Rd, Aston, Birmingham. Telephone: East 3571.

The Birmingham offices of the British Driver-Harris Co. Ltd. are now at Target Wks, Hancock Rd, Birmingham 8. Telephone: East 3761.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Alvis Electrical Co. Ltd. Creditors to send details to liquidator: G. H. Eaves, 47 Mosley St, Manchester 2, by 28 April.

Reco Electronics Ltd. Winding-up order dated 6 March.

Star-Lite Mnfg. Co. Ltd. Creditors to send details to liquidator: A. W. Garnier, 8 Queen St, Cheapside, E.C.4, by 30 April. Formal notice: all creditors to be paid in full.

E. J. Digwood Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 17 April. Persons intending to appear to notify Lewis Lloyd and Co., Bank Chmbrs, 329 High Holborn, W.C.1, by 4 p.m., 14 April.

Ladybird Electric Motors Ltd. Meeting of creditors to be held at Winchester Hse, Old Broad St, E.C.2, on 20 April, at 12 noon.

Dexray Eng. Co. Ltd. Mr H. Lomax, 83 Bridge St, Manchester 3, appointed liquidator at extraordinary general meeting on 27 March for the purpose of voluntarily winding-up.

Litmarts Electrical Ltd. Mr R. W. Hellyer, Brotherton Chmbrs, Westgate, Leeds 1, and Mr J. A. Shires, 24 Basinghall St, Leeds, appointed liquidators at extraordinary general meeting on 27 March for the purpose of voluntarily winding-up.

Longford Electric Co. Ltd. Winding-up order dated 27 March.

Gallagher and O'Brien Enterprises Ltd. Meeting of creditors to be held at 4 New St, Leicester, on 24 April.

Astoria Electrics Ltd. Meetings of members and creditors to be held at 111 Moorgate, E.C.2, on 5 May, at 11 and 11.15 a.m., respectively.

Partnership Dissolved

Sheffield. Partnership between D. L. Evans and F. Crownshaw, electrical suppliers, carrying on business as Evanshaw Electricals at 111 Meadow St, Sheffield, was dissolved as from 1 March. All debts to be paid by D. L. Evans who is carrying on the business.

BANKRUPTCY ACTS

Receiving Orders

Newcastle upon Tyne. D. Fenwick, electrical contractor, formerly carrying on business as Des Fenwick Electrics at 25 Chapel St, Felling. Receiving order dated 28 March.

Derby. L. Treadgold, television, radio and electrical retailer, carrying on business at 198 King St, Alfreton. Receiving order dated 27 March.

Appointment of Trustees

Newcastle upon Tyne. W. D. Mackin, electrical retailer, carrying on business as the Tyne View Electrical Sales and Service, at 34 Tyne View, Lemington, and 28 Wansbeck Rd, Gosforth. Mr E. Taylor, 30-32 Grey St, Newcastle, appointed trustee as from 28 March.

Bolton. P. M. Sykes, radio, television and electrical retailer and repairer, carrying on business as Folds Electrical, at 138 St. Helens Rd and 136 Folds Rd. Mr J. A. Freeman, 8 Manchester Rd, Bury, Lancs, appointed trustee as from 2 March.

Public Examinations

Bradford. K. Ashmore, electrical dealer and contractor, carrying on business as K. Ashmore Electrical Contractors, at 939 Wakefield Rd, Bradford; and 80 Leeds Rd, Windhill, Shipley; and at 370 Leeds Rd, Bradford, as R.S.M. Sewing Machines. Public examination: 10.30 a.m., 15 May, at County Court, Manor Row, Bradford 1.

Bradford. G. Ford, electrical retailer, formerly carrying on business at 15 York Hse, Thorpe Edge. Public examination: 10.30 a.m., 15 May, at County Court, Manor Row, Bradford 1.

Newcastle upon Tyne. A. R. Black, electrical and fancy goods dealer, carrying on business as Ritz Electrics at 188 and 200 Ravenswo'th Rd, Dunston, and 3-4 Front St, Swalwell. Public examination: 10.30 a.m., 23 May, at Court Hse, 56 Westgate Rd, Newcastle.

Release of Trustees

Coventry. S. J. Barnes, electrical contractor, formerly carrying on business at 3 Pim St, Antrim Rd, Belfast. Trustee: W. H. Haigh, 37 Temple St, Birmingham 2, released as from 23 March.

Manchester. E. Baker, electrical contractor, carrying on business as Star Radio and Electric Service, at 157 Lighbowne Rd, Moston. Trustee: W. H. Meredith, 20 Byrom St, Manchester 3, released as from 23 March.

High Court of Justice. J. A. Gould, builder and electrical engineer, formerly carrying on business as Baxendale and Sadler, at 11 Hatherley St, S.W.1. Trustee: R. A. Rogers, 25 Bedford Row, W.C.1, released as from 24 Feb.

Halifax. L. Filby and G. D. Brown, radio, television and electrical engineers, carrying on business as Filby and Brown, at 44 Park St, Brighouse. Trustee: J. L. Williams, 20 North Parade, Bradford 1, released as from 27 March.

Dividend

Manchester. N. J. Parkes and J. R. Parkes, domestic appliance retailers, formerly carrying on business as Trivox Electric at 54 Corwen Ave, Harpurhey. Dividend per £: 1s 1d, payable at Official Receiver's Office, 20 Byrom St, Manchester 3, on 14 April.

Application for Discharge

High Court of Justice. M. T. Goldberg, television, radio and electrical appliance retailer, formerly carrying on business as Malcolm Electronics at 35a Brookfield Rd, E.9. Application for discharge order made on 27 Jan.: discharged as from 27 Oct., 1961.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

A. Andrews and Co. (Electrical Contractors) Ltd. Nom. cap.: £2,000. Dir.: Arthur Andrews, 37 Ernocroft Rd, Marple Bridge, Stockport. Sub.: B. Hargreaves, 44 Guywood La, Romiley, Ches.

Clayhall Electrical Services Ltd., 194-200 Bishopsgate, E.C.2. Nom. cap.: £100. Dirs.: Thos. H. Walker and Doreen M. Walker.

House Electrix (Leatherhead) Ltd., 7 Church Rd, Great Bookham, Surrey. To take over the business of electricians carried on at Gt. Bookham, etc. Nom. cap.: £1,000. Dirs.: Maurice J. Lamberth and Alan D. Barnett.

J. and W. Electrical Ltd., 38 Rood End Rd, Oldbury, Worcs. Nom. cap.: £100. Dirs.: Wm. P. Johnson, A. W. Francis and H. Wakefield.

L. Jones (Electrical) Holdings Ltd., 12 Park Cross St, Leeds 1. Nom. cap.: £100. Dirs.: not named. Subs.: Andrew W. C. Cumming and John Quinn.

John Kent (Electrical Contractors) Ltd., 9 Herne Close, Toddington, Beds. Nom. cap.: £3,000. Dirs.: John Kent and Mrs E. M. Kent.

J. and M. Kogan Ltd., 1 Fernhall Drive, Redbridge, Essex. Manufacturers of and dealers in electrical goods, etc. Nom. cap.: £100. Dirs.: Joe Kogan and Minnie Kogan.

Lectraheat Ltd. Manufacturers of and dealers in electrically operated heating apparatus, etc. Nom. cap.: £100. Dirs.: Frank Bates and Roger M. Bates. Subs.: P. O. Ansell and G. A. Corderoy, 116 Chancery La, W.C.2.

Lipsner-Smith Co. Ltd. Electrical, electronic and wireless engineers and contractors, engineers, etc. Nom. cap.: £20,000. Dirs.: to be appointed by subs. Subs.: Solomon Kaufman and E. Levy, 72 New Cavendish St, W.1.

J. L. Mason and Son Ltd., Lloyds Bank Chmbrs, Wolverhampton St, Dudley, Worcs. Electrical engineers, etc. Nom. cap.: £2,000. Dirs.: John L. Mason, Mrs Millicent I. Mason, Michael Mason and Mrs Betty J. Mason.

Mineral Insulated Cables Ltd., 4 Bennetts Hill, Birmingham 2. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Derek J. Winter and D. Bromilow.

Neston Lampshade Co. Ltd., Ringway, Clay Hills Estate, Neston, Wirral, Ches. Nom. cap.: £100. Dirs.: Robert S. Dawson and Mrs Ailsa J. Dawson.

Norfbrite Ltd. Electrical engineers. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Jean Herbert and Thos. A. Herbert, 156 Strand, W.C.2.

Orchards (Brockenhurst) Ltd., Brookley Rd, Brockenhurst, Hants. To take over the business of electrical contractors, cycle, television and radio retailers and engineers carried on as "Orchards" at Brockenhurst, Hants, etc. Nom. cap.: £10,000. Dirs.: Stanley F. Orchard, Philip G. Orchard, Mrs B. M. L. Orchard, Alec N. Orchard and Albert F. Orchard.

R. and R. Electrics Ltd., 1011 Stockport Rd, Levenshulme, Manchester 19. To take over the business of electrical goods dealers carried on at Levenshulme, Manchester, by J. Robinson and R. G. Ratcliffe, etc. Nom. cap.: £1,000. Permanent dirs.: John Robinson and Ronald G. Ratcliffe.

Philip Ricketts Ltd., The White Hse, Kingston Bagpuize, Berks. Electrical, heating and building contractors and engineers, etc. Nom. cap.: £500. Dirs.: Philip Ricketts and Mrs J. Ricketts.

Rix Bros. Ltd., 4 Wilderness Hill, Cliftonville, Margate. To take over the business of electrical engineers carried on at Cliftonville by L. D. and Gladys H. Rix, etc. Nom. cap.: £2,000. Dirs.: Leonard D. Rix, Gladys H. Rix and John W. Green.

Ruddspeed Ltd., 541-5 Grand Bldgs, Trafalgar Sq, W.C.2. Manufacturers of and dealers in car lamps, etc. Nom. cap.: £100. Dirs.: Kenneth N. Rudd and John Hamblett.

P. and N. Sales Ltd., 14 Edward St, Blackpool. Dealers in electrical, domestic and household appliances, etc. Nom. cap.: £1,000. Permanent dirs.: Patrick B. Murphy and Mrs N. Murphy.

Seweasy (Electrical) Ltd., 35 Southgate St, Gloucester. Importers and exporters of and dealers in sewing machines, etc. Nom. cap.: £2,000. Dirs.: Ronald J. Edwards and Mrs Gwynneth M. Edwards.

Simms Electrical Ltd. Designers, manufacturers of and dealers in electrical and electronic equipment, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: R. G. A. Youard and F. J. Wilson, 18 Austin Friars, E.C.2.

Slades Electrical Contractors Ltd., 73 Virginia Rd, E.2. Nom. cap.: £100. Dirs.: Leslie Slade and Gladys J. Slade.

Stoppafire Ltd. (Eleventh Floor), Kempson Hse, Camomile St, E.C.3. Mechanical and electrical engineers, manufacturers of and dealers in fire extinguishers, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Maurice Bennett and C. J. A. Dixon.

Swedish Lighting Co. Ltd. Dealers in electrical appliances, etc. Nom. cap.: £100. Dir.: Maurice J. Glover. Subs.: Dorothy M. Graeme and Paul G. Graeme, 61 Fairview Ave, Gillingham, Kent.

Toplex Ltd., 13 Fleming Sq, Blackburn. Manufacturers of and dealers in artificial lighting apparatus, electrical plant, etc. Nom. cap.: £2,500. Dirs.: Patrick J. O'Mahoney, Frank Turner and John W. Price.

Werner of Leabrooks Ltd. Electrical contractors, etc. Nom. cap.: £5,000. Permanent dir. and chairman: Horst E. U. Werner, Leabrooks, Derbys. Sub.: Iris E. Holden, 29 Windmill Rise, Somercotes, Derbys.

BUSINESS PROSPECTS

Aldershot. Carl Fisher and Associates, Portland Pl, W.1, architects for Property Investments Consolidation Ltd., proposed shop/office block, Station Rd.

Barrow. Proposed, by John Laing, Mill Hill, N.W.7, 81 dwellings, Dalton La.

Bideford. F. J. and W. R. Tithecott and Son, Bridgeland St, propose 93 dwellings, Abbotsham Rd.

Birkenhead. Streton Lighter Co. propose extensions to Waterloo Pl factory.

Birmingham. Regional Hospital Board, Edgbaston, award £120,000 contract for erection of nurses' quarters, Shelton Hospital, Shrewsbury, to T.G. Construction Ltd., Ettingshall, Wolverhampton.

Bishop Auckland. Development of 21 acres, for workers of Westool Ltd., proposed by Wm. Leech Ltd., St. James St, Newcastle. Edwin Pye and Son, East Parade, propose 60 houses, Woodhouse Close.

Blyth B.C. Tender: 52 flats, maisonnettes, Phoenix St. Engineer.

Bolton. Park La D.C. (Ringley) Ltd. propose 46 acres development, Harwood. Planned: industrial development in Mill Hill St area for W. and J. Leigh, Tower Wks, Mill Hill, Bolton. B.C. proposed: £244,000 college of art and adaptations to technical college costing £100,000.

Brighouse. 90 dwellings, Slead Rd, proposed by Alfred Robinson (Properties) Ltd., Idle, Bradford.

Bristol. Dolphin D.C. Ltd., Dolphin Sq, S.W.1, propose 66 flats, Durdham Pk.

Cardiff C.C. Tender: aged persons' home, Newborough Ave, Llanishen. City Architect.

Cheltenham. Proposed: extensions to brewery and erection of shops on grammar school site for West Country Breweries.

Chester. Michael Lyell and Associates, Yeoman's Row, Brompton Rd, S.W.3, propose central area redevelopment.

Chipping Norton. Planned: 52 dwellings, The Drive, Enstone. Architect: T. Rayson, Beaumont St, Oxford.

Dagenham. Planned: furniture factory, Oxlow La, for J. Ellman and Son, Cooperfield Rd, E.C.3. Light machinery and assembly shop, Pollyte Wks, for J. Crollie.

Dartford. Tender: Min. of Transport admin. bldgs/canteen/workshops/stores, etc., Dartford Tunnel. Consulting engineers: Mott, Hay and Anderson, Caxton St, S.W.1.

Doncaster T.C. Planned: fourth phase of new Doncaster Technical College. Surveyor. Proposed: old people's bungalows, Tickhill Rd area. Surveyor.

Dudley B.C. Planned: two halls of residence and teaching block, Dudley Teachers' Training College, to cost £336,348.

Durham. Francis Johnson, High St, Bridlington, architect for £120,000 extensions proposed at St. Chad's College.

Eastbourne. F. G. Minter, Buckingham Gate, S.W.1, contractors for £250,000 development at Compton Pl Rd for York and London Property Management Ltd. Planned: seven-storey flats, Cliff Rd.

Eastcote. £100,000 three-storey offices, Field End Rd, proposed. Architects: Newman, Levinson and Ptnrs, Mansfield St, W.1.

Edinburgh. Fisons Fertilisers. Felixstowe, Suffolk, plan £220,000 factory, Leith Docks.

Edmonton. B.C. propose multi-tier car park, Claverlings estate, to cost £25,000.

Eccles. Planned by Salford Catholic and Rescue Soc. Inc., Princess St, Manchester, 51 flats, Worsley Rd.

Enfield. A. C. Nicholas, River Front, propose 60 luxury flats, The Ridgeway.

Farnborough. C. G. Robertson, Ladymead Bldg Wks, Guildford, propose 257 dwellings, Prospect estate.

Frinton. £400,000 scheme for 60 luxury flats in one 11-storey and two smaller blocks, proposed by Rush and Tompkins-Pauling Group, Station Rd, Sidcup.

Glasgow C.C. Tender: youth centre, Castlemilk Dr, Castlemilk. City Architect.

Godalming. Langham Cement Products Ltd. propose factory, Langham Trading estate, Catteshall La.

Gosforth. P. J. Steinlet and Son, Queen Sq, Newcastle, architects for R.C. primary school, Hartford Rd.

Grays. Percy Bilton Ltd., Uxbridge Rd, W.5, contractors for Thomas Hedley finished products building, West Thurrock.

Hastings. Sir John Burnett, Tait, Wilson and Ptnrs., Bedford Sq, W.C.1, architects for 42 flats, Albany Hotel site, for Robertson Terrace Flats Ltd.

Hemel Hempstead. Leslie and Co. Ltd., Peel St, W.8, contractors for Honeywell Controls £120,000 factory/offices/canteen, Maxted Rd, Easton Rd.

Hook. Proposed: 62 dwellings, Newnham Rd, by Fitted Homes (Ash) Ltd., Frimley Green Rd, Frimley Green.

Hounslow. R. Batsone, Victoria St, S.W.1, propose four blocks of maisonnettes and 24 shops with 18 maisonnettes, Beavers Farm.

Huddersfield. Y.M.C.A. plan new premises, Northumberland St instead of John William St, as originally proposed. Marlborough Hall, Crossley St.

Hull. Scruton and Co. (Builders) Ltd., West Carr La, Stoneferry Hill, propose to develop 57 acres between Beverley Rd and River Hull.

Ilkeston. Geo. Wimpey and Co. Ltd., Hammersmith Gro, W.6, propose private estate, Kirk Hallam.

Jarrow T.C. Tender: 300 houses, in overspill area. Engineer.

Kempston. Proposed: Fords (Finsbury) Ltd. extension to Chantry Ave engineering works: Ashdown Bros. and Co. (Engineers) Ltd., Chantry Ave, new factory; Kempston Electrical Co. High St, extensions to electrical engineering factory; Neotsford Investments Ltd. College St site development.

Kent C.C. Proposed: police driving school/hostel block/offices/classrooms, Maidstone. County Architect, Maidstone.

Lancs C.C. Tender: single-storey office building, Riddings La, Whalley. County Surveyor, P.O. Box 9, Preston.

Leeds. Holland, Hannen and Cubitts (Scotland) Ltd., Howden, Wallsend-on-Tyne, contractors for £80,000 extensions to Crown Printing Wks. University authorities propose redesigning and extending Woodsley Hall at cost of £75,000.

London. Stock, Page and Stock, Fanshawe St, N.1, architects for flats/offices, New Cross Rd area. Geo. Wimpey Ltd., Hammersmith Gro, W.6, contractors for Sutherland Ave Developments Ltd., 180 flats, five shops, Maida Vale, to cost £750,000. C.C. approve expansion Furzedown teachers' training college for 450 students to cost £571,900. Final stage of Grey Coat (School) Hospital, Grey Coat Pl, rebuilding to cost £114,993. Foundation office, Palace St, S.W.1. Ronald Ward and Ptnrs., Chesham Pl, S.W.1, architects for proposed warehouse/showrooms/offices, etc., Upper Thames St area. McLaughlin and Harvey Ltd., Highbury Gro, N.5, contractors for £95,000 shops/offices, Gt. Castle St. Planned: office block, The Mall, Ealing, architects: W. H. Read and Co., Haven Green Corner, W.5. Morrison Rose and Ptnrs., architects for Uxbridge Rd office block. Wimpole St, W.1. 18-storey offices, two stores, 22 shops, two public houses, proposed King St, Hammersmith. Architects: Shingler and Risdon, Bedford Row, W.C.1.

Longridge. Proposed by Poplar Developments Ltd.: 60 houses, Lower La.

Loughborough. T.C. propose new borough food market with cold storage. Surveyor.

Luton. Planned: six shops/residential/commercial development, Warren Rd area, for Abbey Homesteads Ltd., Thayer St, W.1. Beaumont Securities Ltd., Cromwell Pl, S.W.7, propose bank/shops/maisonnettes, Marsh Rd.

Lytham St. Annes. Albion (Properties Invesments) Ltd. propose multi-storey flats, Heyhouses La.

Mansfield. Planned: factory additions, Bath La, for Goldie, Wade and Goldie Ltd.

Market Harborough U.D.C. Proposed: 20 one-bedroomed flats, community room and warden's residence, Bowden La. Surveyor.

Middlesbrough. Wimpey and Co. Ltd., Fenwick Terrace, Newcastle, to erect 72 houses, Kader Ave. A. Robinson (Contractors) Ltd., Linthorpe Rd, awarded N.E. E.B. contract for engineering and commercial depot, Cargo Fleet La.

Motherwell. Grampian Properties Ltd., St. Vincent St, Glasgow, propose £100,000 hotel, Merry St.

Newbury B.C. Tender: 106 houses, Turnpike Rd estate. Surveyor.

Newcastle. Proposed: £250,000 oil terminal for Jet Petroleum Ltd. New factory, Bermondsy St, for Julius Bernet Ltd., architect: M. White, Tynedale Terr. C.C. Proposed: community centre/shops, Newbiggin Hall estate. City Architect.

Northern Ireland. Jeremiah Ambler Ltd., Bradford, propose to double size of synthetic fibre processing factory, Ballyclare, Co. Antrim.

North Riding C.C. R. Costain, Marton Rd, Middlesbrough, awarded £294,000 contract for Loftus modern school; C. Tennet Ltd., Church Rd, Stockton, awarded £127,000 contract for second stage, Sir Wm. Turner's School, Redcar.

Northumberland C.C. E.C. propose £5,500 re-wiring of Forest Hall Secondary School.

Oxford. Regional Hospital Board, Banbury, provisionally awarded Francis Bros. (Builders) Ltd., Armour Rd, Reading, £127,000 contract for admission unit, Borocourt Hospital. Planned: admin. building, Old Rd, Headington.

Peterlee. W. H. Williamson and Ptnrs., St. Mary's Pl, Newcastle, architects for proposed four-storey office block and five two-storey shops, Town Centre.

Plymouth. Dudley Coles, Bath Rd, to erect factory/offices, Rowden's Reservoir, Stoke, for Allcroft and Co. Ltd.

Ramsgate. Hirst Electronics Ltd., Gatwick Rd, Crawley, propose factory redevelopment.

Redcar. Bradley and Co. (Builders) Ltd., Huntingdon, York, propose 440 dwellings, Ings Farm estate.

Redditch. Prima Industries Ltd., Burton Rd, Dudley, Sedgley, propose industrial development, Burton Rd, Upper Gornal.

Salford. J. Gerrard and Sons Ltd., Swinton, Manchester, contractors for Cussons, Sons and Co. major alterations to Kersal Vale Wks. Cost £69,000.

Sheffield. Gollins, Melville Ward and Ptnrs, Glossop Rd, architects for £175,000 theatre proposed by Sheffield University.

Shildon. U.D.C. propose third stage of street lighting conversion to sodium discharge lighting.

Southampton. Tender: 810-place secondary school, Hightown. Architect.

Staffs. Quickfit and Quartz Group Ltd. propose £500,000 factory of 90 acres at Stone, Staffs.

Stevenage. G. Percy Trentham Ltd., Rainham, Essex, awarded superstructure contract for £1,250,000 plant at New Town for Bowater Packaging Co. Architects: Farmer and Dart, Romney Hse, Tufton St, S.W.1. T.D. Tools Ltd. plan £20,000 extensions to factory. Architect: A. M. Priestman, One Churchyard, Hitchin.

Stockton. Geo. Wimpey and Co. Ltd., Cargo St, Middlesbrough, to develop eight acres at Farfield for housing. Tender: £34,000 old people's flatlets, The Hardwick estate. Architect.

Sunderland. 60 houses, East Herrington, proposed by J. W. Ridley Ltd., builders, West Sunniside. E.C. propose to rebuild Milton Hall, Brampton, as residential school for handicapped boys. Steinlet and Son, Queen Sq, Newcastle, architects for proposed R.C. primary school, South Hylton.

Surbiton. Fassnidge, Son and Norris Ltd., High St, Uxbridge, awarded contract for

Business Prospects—continued

Decca research laboratories. Proposed: ten-storey office block, Ewell Rd. Architects: Shailer and Lavender, Lincoln's Inn Field, W.C.2.

Tenterden. Proposed: 52 houses, Mill Farm estate, by Hamlin Development Co. Ltd., Palace St, Canterbury.

Thatcham. Gregory Housing Ltd., Farncombe Rd, Worthing, propose 240 houses, Chapel St.

Torquay. Planned by Tibstown Investments Ltd.: 177 flats and maisonnettes, Lydwell Rd.

Wallasey C.B.C. Tender: three five-storey blocks flats, maisonnettes, Twickenham Dr, Leasowe. Architect.

Wigan C.B.C. Tender: 43 dwellings, Naithwaite estate. Engineer.

Whitley Bay. Waring and Netts, Jesmond Rd, Newcastle, plan houses, Rocky Island; flats, public house extension, West Terr, Seaton Sluice.

Winsford. U.D.C. to erect factories on industrial estate for Tithebarn Products Ltd., Houghton St, Southport, and for Plastics Coatings Ltd., Guildford.

Wycombe. A. D. Jameson, Chalklands, Bourne End, propose 90 houses, Coresend.

Yeovil. S.E.B. propose engineering workshops, West Hedford.

York. Planned: 74 houses, The Orchard estate, by Shepherd Developments, Blue Bridge La.

MEETINGS TO NOTE

THURSDAY, 13 APRIL

I.E.E. Seventh Graham Clark Lecture. (Joint meeting with Civils and Mechanicals.) "Resources Human and Material of the Commonwealth," H.R.H. Prince Philip. Gt. George St, S.W.1. 5.30 p.m.

I.E.E. (N. Lancs). "The Provision of Adequate Electrical Installations in Buildings—Small Industrial Premises," J. A. Sharp. N.W.E.B. Demonstration Theatre, Duke St, Barrow. 7.30 p.m.

I.E.E. (W. Wales). "The Determination of the Electrical Characteristics of an Arc Furnace," J. Ravenscroft. Conference Room, S.W.E.B., The Kingsway, Swansea. 6 p.m.

I.E.E. (N. Scotland). "Some Considerations in the Application of Power Rectifiers and Converters," J. P. McBreen. Electrical Engineering Dept., Queen's College, Dundee. 7 p.m.

Society of Instrument Technology (Liverpool). Address by R. S. Medlock. M.A.N.W.E.B. Industrial Development Centre. 7 p.m.

Diesel Engineers and Users' Association. Annual luncheon. Connaught Rooms, London.

I.E.E. (Sheffield Graduates and Students). "The Use of Electricity in Hazardous Atmospheres," P. A. D. Sheen. College of Technology, Doncaster.

A.S.E.E. (Bradford and District). "Eddy-current Controlled Slip Couplings as Drives and Tension Brakes," R. H. Wheat. Midland Hotel. 7.30 p.m.

A.S.E.E. (Oxford and Districts). "Radio-Astronomy," Dr A. D. Petford. Reactor School, A.E.R.E., Harwell. 5.45 p.m.

FRIDAY, 14 APRIL

I.E.E. (Sheffield). Annual dinner/dance. Victoria Hotel, Sheffield. 7.30 p.m.

I.E.E. (N. Scotland). "Some Considerations in the Application of Power Rectifiers and Converters," J. P. McBreen. Robert Gordon's Technical College, Aberdeen. 7.30 p.m.

I.E.E. (N.E. Graduates and Students). "Noise: Its Effects, Measurement and Control," J. R. Anderson. Grey Hall, King's College, Newcastle upon Tyne. 6.30 p.m.

E.P.E.A. Annual dinner. Palmerston Restaurant, Bishopsgate.

Society of Instrument Technology (Midland). A.G.M. Lecture Theatre, Byng Kendrick Suite, Gosta Green College of Technology, Aston St, Birmingham. 7 p.m.

MONDAY, 17 APRIL

I.E.E. Discussion: "The Education of Engineers—All's Well?" Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (N. Eastern). A.G.M. and Conversazione. Royal Station Hotel, Newcastle upon Tyne. 6.30 p.m.

I.E.E. (N. Staffs). "The Potentialities of Artificial Earth Satellites for Radiocommunication," W. J. Bray. Duncan Hall, Stone, Staffs. 7 p.m.

I.E.E. (Southern). "Progress in Oil-filled Cables and Their Accessories," A. N. Arman, F. J. Miranda and G. R. Bishop; and "The Influence of Ageing on the Characteristics of Oil-filled Cable Dielectrics," P. Gazzana-Priaroggia, G. L. Palandri and U. A. Pelagatti. The Technical College, Brighton. 6.30 p.m.

I.E.E. (Scottish Electronics and Measurement Group). A.G.M. and "Hydraulics v. Electrics," D. Firth. Royal College of Science and Technology, Glasgow. 6 p.m.

I.E.E. (Western Supply Group). "The Operation of Large Electrical Supply Systems," L. B. Law. South Wales Institute of Engineers, Park Pl, Cardiff. 6 p.m.

Birmingham Electric Club. "Ceramics for the Electrical Industry," E. C. Williams. Grand Hotel. 6.15 p.m.

Society of Instrument Technology (Bristol). A.G.M. University of Bristol, Dept. of Physics, The Royal Fort. 7.30 p.m.

I.E.S. (Bath and Bristol). A.G.M. Gardiner, Sons and Co. Showroom, Bristol.

I.E.S. (Leeds). "The Artistic Use of Lighting in Multi-camera Technique," H. E. H. Mayhew. British Lighting Council, 24 Aire St. 6.15 p.m.

Ipswich and District Electrical Association. "The Future of Television in Britain," T. A. H. Marshall. Electric Hse. 7.15 p.m.

E.D.A. Rural Electrification Conference at Sutton Bonington until 21 April.

I.E.E. (Cardiff Graduates and Students). A.G.M. and "The Engineer as Manager," J. E. Cule. South Wales Institute of Engineers, Cardiff. 7 p.m.

Glasgow Youth Employment Service. Careers meetings for Mechanical, Civil and Electrical Engineering at Berkeley Hall, St. Andrew's Halls, Berkeley St.

A.S.E.E. (Bristol and West). "Electricity in Printing," B. I. O'Donnell. The Royal York Hotel, Bath. 8 p.m.

TUESDAY, 18 APRIL

I.E.E. (N. Midland Utilisation Group). "The Application of Irradiation in Industry," M. C. Crowley-Milling. Leeds and County Conservative Club, South Parade, Leeds 1. 6.30 p.m.

I.E.E. (Southern). "The Future of 'Electrics' and 'Electronics' in Aircraft and Guided Missiles," The Rt Hon The Viscount Caldecote. (Joint meeting with Royal Aeronautical Society.) Farnborough Technical College. 6.15 p.m.

I.E.E. (S.E. Scotland). "Radiocommunication in the Power Industry," E. H. Cox and R. E. Martin. Carlton Hotel, Edinburgh. 7 p.m.

I.E.S. (Liverpool). A.G.M. Electrical Industrial Development Centre of M.A.N.W.E.B., Paradise St. 6 p.m.

Housecraft Advisers' Conference at Harrogate until 21 April.

A.S.E.E. Discussion: "Aspects of the Design of Electrical Installation Materials and Equipment." I.E.E. Lecture Theatre, Savoy Pl, W.C.2. 6.30 p.m.

A.S.E.E. (Oxford and Districts). "Fault Tracing in Electrical Apparatus." Employment Exchange. 8 p.m.

A.S.E.E. (West Kent). "Fire Fighting," H. E. Evans. Coniston Hotel, Sittingbourne. 7.30 p.m.

WEDNESDAY, 19 APRIL

I.E.E. (Supply Section). "Progress in Oil-filled Cables and Their Accessories," A. N. Arman, F. J. Miranda and G. R. Bishop; and "The Influence of Ageing on the Characteristics of Oil-filled Cable Dielectric," P. Gazzana-Priaroggia, G. L. Palandri and U. A. Pelagatti. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Sheffield). "Silicon Power Rectifiers," A. J. Blundell, A. E. Garside, R. G. Hibberd and I. Williams. North Lindsey Technical College, Scunthorpe. 6.30 p.m.

Society of Instrument Technology (Data Processing Section) A.G.M., 6.15 p.m.; and "Electronic Telephone Exchanges," T. H. Flowers, 7 p.m. Manson Hse, 26 Portland Pl, W.1.

Society of Instrument Technology (Cheltenham). A.G.M. followed by Presidential Address: "Instrumentation Developments in the Petroleum Industry," G. C. Eltenton. Belle Vue Hotel. 7.30 p.m.

British Institution of Radio Engineers (Southern). "The Development of an Ammonia Maser Oscillator as a Frequency Standard," A. Mitchell. Lanchester Bldg, Southampton University. 7 p.m.

British Institution of Radio Engineers (Merseyside). "The History of Radio," G. R. M. Garrett. Adelphi Hotel, Liverpool. 7 p.m.

Society of Instrument Technology (Newcastle). "The Design, Application and Selection of Automatic Control Valves," P. Stone. Conference Room, Broadway Hse, Oxford St. 7 p.m.

Institution of Plant Engineers. Annual Conference. Imperial Hotel, Blackpool, until 21 April.

A.S.E.E. (Wolverhampton and District). "Resistance Welding," H. Shurley. Chamber of Commerce, District Bank Chmbrs, Lichfield St. 7.45 p.m.

THURSDAY, 20 APRIL

I.E.E. (Utilisation Section). "Aluminium in Electrical Engineering," P. J. H. Rata; "Diesel Railway Locomotives," A. D. Swanston and B. W. Towell; and "Automatic Programming for Hot Reversing Mills," T. E. S. Rickard. (Joint meeting with London Graduates and Students.) Savoy Pl, W.C.2. 6 p.m.

I.E.E. (Cambridge Electronics and Measurement Group). "The Potentialities of Artificial Earth Satellites for Radiocommunication," W. J. Bray. Cavendish Laboratory. 8 p.m.

Society of Instrument Technology (E. Midlands). A.G.M. followed by Presidential address. College of Further Education, Greenclose La, Loughborough. 7.15 p.m.

I.E.E. (Southern Graduates and Students). A.G.M. Portsmouth College of Technology. 6.30 p.m.

Engineering, Marine, Welding and Nuclear Engineering Exhibition at Olympia until 4 May.

FRIDAY, 21 APRIL

I.E.E. (Rugby). Rugby Engineers' Ball. Leofric Hotel, Coventry.

Institution of Works Managers. Conference at Linden Hall Hotel, Bournemouth, until 23 April.

British Institution of Radio Engineers (S. Midlands). A.G.M. and "The Mesa Transistor and its H.F. Applications," D. H. Mehrtens. N. Glos. Technical College, Cheltenham. 7 p.m.

MONDAY, 24 APRIL

I.E.E. (E. Anglian). "A Basis for Short-Circuit Ratings for Paper-Insulated Cables up to 11 kV," L. Gosland and R. G. Parr. Electric Hse. Ipswich. 6.30 p.m.

I.E.E. (S. Midlands Electronics and Measurement Group). A.G.M. and "A Review of Progress in Ultrasonic Inspection Techniques," A. C. Rankin. James Watt Memorial Institute, Birmingham. 6 p.m.

I.E.E. (N. Staffs Graduates and Students). A.G.M. at Stafford. 7.30 p.m.

I.E.S. (Birmingham). "Colliery Electrification—Mine and Washery Lighting," G. W. Hall. Regent Hse, St. Phillip's Pl, Colmore Row. 6 p.m.

TUESDAY, 25 APRIL

I.E.E. (Measurement and Control Sections). "Simulation of Intelligence," Professor D. M. Mackay. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (N.W. Supply Group). "An Electrostatic Dust Monitor," D. H. Grindell. Engineers' Club, Manchester. 6.15 p.m.

Society of Instrument Technology. "Instrumentation in the Iron and Steel Industry," A. H. Pople. Manson Hse, 26 Portland Pl, W.1. 7 p.m.

WEDNESDAY, 26 APRIL

I.E.E. (Electronics and Communications Sections). "Data Transmission," R. H. Franklin and J. Rhodes. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Hatfield). "Railway Electrification in Great Britain," D. H. McCracken. Hatfield Technical College. 7 p.m.

I.E.E. (S. Midlands Graduates and Students). A.G.M. Lecture Theatre, Byng Kenrick Suite, College of Advanced Technology, Birmingham. 6.30 p.m.

Institution of Mechanical Engineers. A.G.M. Birdcage Walk, S.W.1. 6 p.m.

Royal Society of Arts. "The Training of Scientists and Engineers for Industry," Sir John Cockcroft. John Adam St, W.C.2. 2.30 p.m.

British Institution of Radio Engineers. Symposium: "Electronic Counting Techniques." London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

THURSDAY, 27 APRIL

I.E.E. The Fifty-second Kelvin Lecture: "Medical Electronics," Professor R. F. Woolmer. Savoy Pl, W.C.2. 5.30 p.m.

Institution of Mechanical Engineers (Steam Plant Group). Discussion: "Acid Cleaning as Applied to Steam Power Plant." 1 Birdcage Walk, S.W.1. 6 p.m.

Society of Instrument Technology (Chester). A.G.M. Lecture Theatre, Admin. Bldg, The Associated Ethyl Co. Ltd., Oil Sites Rd, Ellesmere Port, Wirral. 7 p.m.

FRIDAY, 28 APRIL

I.E.E. (N.E. Graduates and Students). A.G.M. Grey Hall, King's College, Newcastle upon Tyne. 6.30 p.m.

SATURDAY, 29 APRIL

Association of Electrical Machinery Trades. Annual Convention at Queen's Hotel, Eastbourne, until 2 May.

KEEPALITE

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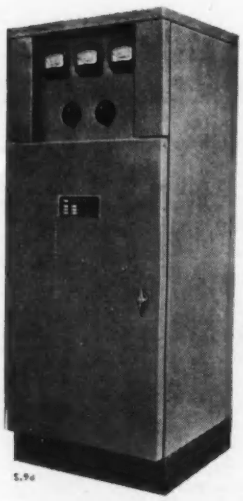

Keepalite, the Chloride Company's automatic emergency lighting system, is now equipped exclusively with the new Chloride Planté cell which occupies only half the space previously needed by cells of the Planté type of equivalent capacity. Keepalite thus adds this important advantage to the many virtues that have made it the most trusted and widely used emergency lighting system in Great Britain. Despite its small size and light weight, the new cell is extremely robust and has all the great length of life associated with the Planté type of construction. As always, the advisory service of the Company's electrical engineers is at the call of electrical contractors and engineers who are interested in emergency lighting installation.

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CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

BOROUGH OF SCUNTHORPE

Electrical Re-wiring to Modern Standards of 238 Pre-war Council Houses, Crosby Estate

TENDERS are invited from approved Electrical Installation Contractors to carry out the above work.

Forms of Tender and Specification may be obtained from the Housing Manager, Housing Department, Lincoln Gdns, Scunthorpe.

Sealed tenders must be received by the Town Clerk, Municipal Offices, 34 High St, Scunthorpe, in the envelope provided, not later than noon on 27 April, 1961.

It is a provision of the contract that the successful tenderer(s) will be required to enter into a bond. The Corporation do not bind themselves to accept the lowest or any tender. (A 334)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

275 kV Transmission Line

TENDERS are invited for the construction of a 275 kV double circuit steel tower line, approximately 54 miles route length between Cruachan and Windyhill, in the Counties of Argyll, Perth, Dunbarton and Stirling. Tender Documents may be obtained on application with deposit of £2 2s (returnable) to the Engineers: Messrs Merz and McLellan, 72a George St, Edinburgh 2. The Board do not bind themselves to accept the lowest or any Tender.
3 April, 1961. (A 335)

COUNTY BOROUGH OF BURY

Supply of Lamps

TENDERS invited for supply of lamps for all Corporation Departments during 1961-62. Sodium, Fluorescent and Tungsten lamps will be required.

Further particulars and Form of Tender from Street Lighting Superintendent, Street Lighting Department, Hacking St, Bury.

Tenders enclosed in a plain sealed envelope endorsed "Tender for Supply of Lamps," must reach me not later than 25 April, 1961.

EDWARD S. SMITH,
Town Clerk.

Town Hall,
Bury.
6 April, 1961. (A 368)

APPOINTMENTS VACANT

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER

REQUIRED at Rugeley Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Class L, Grade 8, £1,350/£1,500 per annum, plus 10% for shift allowance.

Applicants should possess a Higher National Certificate or equivalent qualification and have had operating experience in a modern power station with high pressures and temperatures.

Apply, quoting Vacancy No. 96/61MD, on Form AE6, available from the Station Superintendent, Rugeley Power Station, Rugeley, Staffs, to whom they should be returned by 24 April, 1961. (A 369)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER (PLANNING)

BASINGSTOKE District of No. 3 (Portsmouth) Sub-Area. Salary: N.J.B. Class F, Grade 11 (£765/£870 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks and to undertake standby duties if required. Suitable technical qualifications are necessary.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton La, Cosham, Portsmouth, and returned to him, quoting Z.1228, not later than 24 April, 1961.

GENERAL ASSISTANT ENGINEER

Construction Department of No. 2 (Newbury) Sub-Area, located at Newbury (East Sub-section). Salary: N.J.B. Class M, Grade 18 (£715/£805 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist with the installation and erection of plant, equipment and overhead lines, the laying of cables and other constructional work on all distribution systems up to and including 33 kV.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1317, not later than 24 April, 1961.

SENIOR SERVICE CENTRE ASSISTANT

Newbury District of No. 2 (Newbury) Sub-Area. Salary: N.J.C. 2 (£700/£775 per annum). N.J.C. Conditions of Service.

Applicants must be capable of supervising staff and should have had experience in all showroom duties. They should have a sound knowledge of domestic and commercial apparatus, window displays, sales procedures, the application of tariffs and consumer service.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1327, not later than 24 April, 1961.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. (A 377)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT ENGINEER (INSTRUMENTS)

REQUIRED at Rugeley Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Class L, Grade 9, £1,275/£1,410 per annum.

The successful applicant will be required to assist the Instrument Engineer in the maintenance of all instruments and automatic controls and should have extensive experience of modern Power Station instrumentation and automatic boiler control. Experience of telemetering systems and a good working knowledge of electronics desirable. Applicants should possess a Higher National Certificate in Electrical Engineering or its equivalent.

Apply, quoting Vacancy No. 97/61MD, on Form AE6, available from the Station Superintendent, Rugeley Power Station, Rugeley, Staffs, to whom it should be returned when completed by 24 April, 1961. (A 370)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chilterns Sub-Area

THIRD ASSISTANT ENGINEERS
SUB-AREA HEADQUARTERS

The following appointments are in the Operation and Maintenance Section of the Sub-Area Engineer's Department:

Appointment (a) in Maintenance Sub-Section. 71/61.N.

The duties will include the supervision of the repair and maintenance of 33 kV substation plant and equipment, underground cables and overhead lines by direct and contract labour.

Appointment (b). Commissioning and Protective Gear Sub-Section. 72/61.N.

The duties will include the commissioning of substations up to 33 kV, including protection equipment and ancillary apparatus, pressure testing and fault location.

Salary for both appointments: N.J.B. Class L, Grade 10 (£1,190/£1,325).

Apply by letter to the Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend St, Bedford, by 28 April, 1961, and indicate preference for appointment (a) or appointment (b).

Northmet Sub-Area

TOTTENHAM DISTRICT
SENIOR SALES REPRESENTATIVE
(Ref. 1048) 70/61.R.

Candidates should have had practical training with experience of domestic and small commercial and industrial installations. An ability to sell appliances with advice to consumers on supply matters, tariffs and apparatus is required.

Salary: N.J.C. Grade 2 (£700/£775) plus London Allowance.

Apply by letter to J. A. K. Bowerman, A.M.I.E.E., Manager, Eastern Electricity Board, Tottenham District, 315 High Rd, Tottenham, London, N.15, by 5 May, 1961.

EDMONTON DISTRICT
DISTRICT COMMERCIAL ASSISTANT
(Ref. 1049) 69/61.R.

Candidates should be fully experienced in modern installation practice, able to prepare specifications and competitive quotations and be competent to design thermal storage heating schemes, particularly floor-warming. A sound knowledge of the tariffs and their application, including supply by special agreement, is necessary.

Salary: N.J.C. Grade 3 (£780/£880) plus London Allowance.

Apply by letter to C. A. Baker, B.SC. (ENG.)LOND., M.I.E.E., Manager, Eastern Electricity Board, Edmonton District, 305 Fore St, Edmonton, N.9, by 28 April, 1961.

Northmet Sub-Area

TOTTENHAM DISTRICT
SECOND ASSISTANT ENGINEER
(Ref. 1051) 73/61.N.

Candidates should have had a sound technical training and considerable experience in the construction, operation and maintenance of underground distribution systems at voltages up to and including 33 kV.

Salary: N.J.B. Class F, Grade 7 (£1,040/£1,165) plus London Allowance.

Apply by letter to J. A. K. Bowerman, A.M.I.E.E., Manager, Eastern Electricity Board, Tottenham District, 315 High Rd, Tottenham, N.15, by 28 April, 1961.

HORNSEY DISTRICT
THIRD ASSISTANT ENGINEER
(Ref. 1026) 74/61.N.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

Salary: N.J.B. Class G, Grade 9 (£965/£1,090) plus London Allowance.

Apply by letter to C. Bradley, M.I.E.E., Manager, Eastern Electricity Board, The Broadway, Crouch End, London N.8, by 28 April, 1961. (A 379)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 46s. per inch, and all other classified advertisements at 3s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

MIDDLESEX COUNTY COUNCIL
EDUCATION COMMITTEE
Twickenham Technical College
Egerton Road, Twickenham

Principal: J. P. Wolfenden, M.SC., M.I.E.E.
DEPARTMENT OF ELECTRICAL ENGINEERING AND PHYSICS

APPLICATIONS are invited from qualified engineers for:
TWO NEW POSTS OF LECTURER

Duties to commence 1 Sept., 1961.

(I) Lecturer in Electronics with experience in transistor applications.

(2) Lecturer in Electrical Power with experience in the control of electrical machines.

The work of the department is rapidly expanding and includes Higher National Certificate, Higher National Diploma, Part III Examination of the Institution of Electrical Engineers, Post Graduate and Special Lecture courses. Large extensions opened in 1960 have provided well equipped laboratories and workshops.

Candidates should possess a degree or graduate equivalent and have had suitable industrial experience. Part-time or full-time teaching experience is desirable but not essential.

Salary within the range of £1,408/£1,601 per annum.

Further particulars and application forms may be obtained from the Principal to whom completed forms should be returned within 14 days.

C. E. GURR, M.SC., PH.D.,
Chief Education Officer.
(A 357)

CAMERON HIGHLANDS
HYDRO-ELECTRIC SCHEME, MALAYA.

ELECTRICAL INSPECTOR

REQUIRED by Consulting Engineers for Site Construction Staff, Electrical Inspector to oversee the erection and setting to work of generators, switchgear, cabling, etc., in connection with Hydro-Electric Stations and associated stepdown substations. The plant involves some 106 MW of generating plant.

The work will be entirely in the field. The Inspector would act under the direction of the appropriate Assistant Resident Engineer.

The applicant should be well qualified by education and experience to supervise the several aspects of the electrical side of power station plant.

The appointment would be for approximately three years with short home leave at a time near the middle of the period suited to the requirements of the work, and commence about October, 1961. Passages provided, free medical attention, transport allowance, concessionary housing. Salary: £1,900 p.a. Preference will be given to single men or men prepared to fulfil the engagement without wife or family.

Applications should be made in writing within 14 days of the publication of this advertisement plainly marked I.E. to Preece, Cardew and Rider, Consulting Engineers, 8, 10 and 12 Queen Anne's Gate, London S.W.1.
(A 351)

MIDDLESEX COUNTY COUNCIL
County Architects Dept.
ENGINEERING ASSISTANT
APT. III (£1,005/£1,185 P.A.)

REQUIRED for section dealing with maintenance of electrical installations in schools and other county buildings. Prescribed conditions. Established, pensionable. Application forms from County Architect, 1 Queen Anne's Gate Bldgs, Dartmouth St, S.W.1, returnable by 24 April. (Quote: F.972 ET.) (A 353)

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the post of
ASSISTANT PURCHASING OFFICER
within the Purchasing Department at Board Headquarters.

The duties comprise responsibility for bulk purchase arrangements, supervision and co-ordination of purchases, stocks and stores disposal within the distribution areas; the purchase of supplies for 275 kV and 132 kV transmission system; printing, stationery and other requirements for Board Headquarters. Candidates should have a thorough knowledge of suppliers within the electrical manufacturing industry, and possess experience in the purchasing of plant, equipment and stores for the distribution of electricity.

Salary: N.J.M.C. Class C, Grade 6, £2,380/£2,595 per annum.

Applications, quoting reference number P.1/61, should be submitted on the standard form AE.6 to the Secretary, Inverlair Ave, Glasgow S.4, not later than 24 April, 1961.
(A 344)

THE SOUTH WALES ELECTRICITY BOARD

GENERAL
ASSISTANT ENGINEER

APPLICATIONS are invited for the position of General Assistant Engineer in the West Mon District (Bargoed) of the Monmouthshire and Mid-Wales Area.

The duties of this post will be of a general nature and preference will be given to Engineers possessing the Higher National Certificate in Electrical Engineering.

Salary: N.J.B. Class H, Grade 11, Scale 6 (£890/£1,015 per annum).

Applications stating age, present position, salary, qualifications and experience should be addressed to the Manager, Monmouthshire and Mid-Wales Area, Llywelyn Rd, Cwmbran, Mon, to arrive not later than 29 April, 1961.

Please quote reference 49/61/ET, endorsing envelope "Assistant Engineer."

R. G. WILLIAMS,
Secretary.
(A 358)

CENTRAL ELECTRICITY GENERATING BOARD
Eastern Division

APPLICATIONS are invited for the following appointments in the System Operation Department, Thames North Grid Control Centre, Redbourn, near St. Albans, Herts.

FOURTH ASSISTANT ENGINEERS

Salary: N.J.B., Class BX, Grades 9-11, within the range of Scales 8-10, £855/£1,325 per annum.

The commencing salary will be within the above range at a point commensurate with qualifications and experience. The minimum technical qualification required is the Higher National Certificate in Electrical Engineering.

Some generating station and/or transmission/technical experience is desirable. The duties are on day work and are of a general technical and statistical nature, but applicants must be prepared ultimately to undertake shift duties in the Grid Control Room.

Forms of application (AE6/ACT) may be obtained from the Board's Headquarters, or from any Divisional Offices of the Board, and should be addressed to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, to arrive not later than 22 April, 1961, quoting Reference S.V. No. 1398. (A 339)

ELECTRIC POWER UNDERTAKING FOR THE ISLAND OF SARK

OFFERS are invited for the outright purchase of the electricity undertaking of Sark. Established in 1948 with local private capital, the network serves 500 resident population with a steadily rising demand. 32,000 visitors come every year from which island hotels cater for 3,000.

Sark, apart from its mild climate and beautiful scenery, is unique among the four Channel Islands. Not only is it completely self-governed democratically, but there are no Death Duties nor Income Tax; no Property nor Profits Tax; there are no Rates nor Social Services; no Company Law nor Trade Unions; there are no motor cars nor building restrictions. In spite of cheap drink and tobacco, there is an annual Budget Surplus. This charming backwater has remained little changed for 400 years and Sark, therefore, is becoming increasingly popular with retired people.

The reason for selling is simple. Although there is adequate finance, very healthy profits and technically sound plant planned for easy expansion, the Founder-Owner is considering retiring in Sark; if not now, then in a year or two.

An alternative would be to accept a working partner, with or without capital. In that case, the right man would be middle aged and with the necessary skill and technical knowledge and, above all, a genuine liking for the life here.

In the station there are three National-Fielding Horizontal diesel alternator sets at 62 kWA at 500 r.p.m., 415/3/50 with full metering, shutdown protection and automatic closed circuit cooling. Switchboard and cooling system capacity is 750 kVA and two further 130 kVA sets are planned for 1963 to meet growing demand. Distribution is at 6·6 kV with a capacity of 1,500 kVA. There is a showroom and an office. The undertaking cannot be nationalised nor is the Concession restricted in profits, tariff or term of years.

Robson Electric Supply Co., Sark, Channel Islands (Sark 53). (A 289)

CAMERON HIGHLANDS
HYDRO-ELECTRIC SCHEME, MALAYA

SENIOR MECHANICAL
AND ELECTRICAL ENGINEER

REQUIRED by Consulting Engineers for site construction staff, Senior Mechanical and Electrical Engineer to oversee the erection and setting to work of hydro-electric generating plant, switchgear, cabling, etc. The plant includes 100 MW of Pelton and 5½ MW of Francis driven generating plant.

The work would be entirely in the field. The Engineer would act under the general direction of the Chief Resident Engineer and may expect to have one Mechanical and one Electrical Assistant Engineer.

The appplicant should be a Corporate member of one of the Senior Institutions and have had substantial experience in a similar capacity.

The appointment would be for approximately 2½ years commencing in the latter part of 1961. Passages provided, free medical attention, transport allowance, concessionary housing, salary: £3,800 p.a.

Applications should be made in writing within three weeks of the publication of this advertisement, giving full details of previous experience, age, marital status, etc., and clearly marked Senior Mechanical and Electrical Engineer, to Preece, Cardew and Rider, Consulting Engineers, 8, 10 and 12 Queen Anne's Gate, London S.W.1.
(A 337)

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

ASSISTANT COAL AND ASH HANDLING ENGINEER
NOTTINGHAM POWER STATION
Vacancy No. 72/61.

APPLICATIONS are invited for the position of Assistant Coal and Ash Handling Engineer at Nottingham Power Station, Queen's Dr, Nottingham.

Candidates should have knowledge of the operation of coal, ash and dust handling plant at a large modern power station, and of the organisation and planning of coal supplies by road and rail.

The duties of the successful applicant will include the organisation of ash disposal by lorry transport.

Salary will be in accordance with Class K, Grade 10 (£1,115/£1,245 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 21 April, 1961.

ASSISTANT EFFICIENCY ENGINEER
NOTTINGHAM POWER STATION
Vacancy No. 73/61.

Applications are invited for the position of Assistant Efficiency Engineer at Nottingham Power Station, Queen's Dr, Nottingham.

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates who are Corporate Members of a recognised professional institution or who hold qualifications leading to such membership.

Salary will be in accordance with Class K, Grade 8 (£1,275/£1,410 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 21 April, 1961.

SECOND ASSISTANT STATION CHEMIST
NOTTINGHAM POWER STATION
Vacancy No. 74/61.

Applications are invited for the position of Second Assistant Station Chemist at Nottingham Power Station, Queen's Dr, Nottingham.

Candidates should have had previous experience in a power station laboratory and should hold the Higher National Certificate in Chemistry. They should be familiar with the methods of sampling and analysis of coal, water and oil, and with the interpretation and application of the analytical results.

Salary will be in accordance with Class K, Grade 11 (£1,040/£1,165 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 21 April, 1961.

ASSISTANT ENGINEERS (RELIEF)
NOTTINGHAM POWER STATION
Vacancy No. 75/61.

Applications are invited for the positions of Assistant Engineers (Relief) at Nottingham Power Station, Queen's Dr, Nottingham.

Applicants should have received a sound electrical training and have had experience of the operation and control of modern high-pressure boiler and turbine plant. Preference will be given to candidates who possess the Higher National Certificate in mechanical or electrical engineering or its equivalent.

Salary will be in accordance with Class K, Grade 12 (£965/£1,090 per annum) of the National Joint Board Agreement, plus 10% allowance whilst engaged on shift duties.

Closing date for receipt of applications: 21 April, 1961.

ASSISTANT ENGINEER (CONTROL) (RELIEF)
NOTTINGHAM POWER STATION
Vacancy No. 76/61.

Applications are invited for the position of Assistant Engineer (Control) (Relief) at Nottingham Power Station, Queen's Dr, Nottingham.

Candidates for this post should be suitably qualified and have had experience in the control room.

Salary will be in accordance with Class K, Grade 14 (£825/£940 per annum) of the

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National Joint Board Agreement, plus appropriate allowance whilst engaged on shift duties.

Closing date for receipt of applications: 21 April, 1961.

ASSISTANT SHIFT CHARGE ENGINEER
NOTTINGHAM POWER STATION
Vacancy No. 78/61.

Applications are invited for the position of Assistant Shift Charge Engineer at Nottingham Power Station, Queen's Dr, Nottingham.

Applicants should preferably possess the Higher National Certificate or its equivalent, and have had responsible experience in the operation of modern power station plant. Pulverised fuel experience will be an advantage.

Salary will be in accordance with Class K, Grade 8 (£1,275/£1,410 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 21 April, 1961.

ASSISTANT ENGINEER (RELIEF)
STAYTHORPE "A" POWER STATION
Vacancy No. 80/61.

Applications are invited for the position of Assistant Engineer (Relief) at Staythorpe "A" Power Station, nr. Newark, Notts.

Applicants should have received a sound electrical training and have had experience of the operation and control of modern high-pressure boiler and turbine plant. Preference will be given to candidates who possess the Higher National Certificate in mechanical or electrical engineering or its equivalent.

Salary will be in accordance with Class K, Grade 12 (£965/£1,090 per annum) of the National Joint Board Agreement, plus 10% allowance whilst engaged on shift duties.

Closing date for receipt of applications: 28 April, 1961.

ASSISTANT ENGINEER (OPERATION)
DRAKELOW "A" POWER STATION
Vacancy No. 81/61.

Applications are invited for the position of Assistant Engineer (Operation) at Drakelow "A" Power Station, nr. Burton-on-Trent, Staffs.

Experience desirable in control of boilers and turbines at high pressure and temperature, pulverised fuel, together with electrical control room experience. Technical qualifications to Higher National standard desirable.

Salary will be in accordance with Class J, Grade 10 (£1,040/£1,165 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 28 April, 1961.

SHIFT CHARGE ENGINEER
BURTON-ON-TRENT POWER STATION
Vacancy No. 82/61.

Applications are invited for the position of Shift Charge Engineer at Burton-on-Trent Power Station, Wetmore Rd, Burton-on-Trent, Staffs.

Sound technical training and practical experience in the control and operation of steam generating plant and main switchgear are required. Appropriate qualications an advantage.

Salary will be in accordance with Class E, Grade 7 (£965/£1,090 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 28 April, 1961.

ASSISTANT SHIFT CHARGE ENGINEER
BURTON-ON-TRENT POWER STATION
Vacancy No. 83/61.

Applications are invited for the position of Assistant Shift Charge Engineer at Burton-on-Trent Power Station, Wetmore Rd, Burton-on-Trent, Staffs.

Applicants should possess H.N.C. or equivalent qualifications and have experience in power station operation.

Salary will be in accordance with Class E, Grade 9 (£825/940 per annum) of the National Joint Board Agreement, plus an allowance for shift duties.

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Closing date for receipt of applications: 28 April, 1961.

SECOND ASSISTANT STATION CHEMIST
HIGH MARNHAM POWER STATION
Vacancy No. 84/61.

Applications are invited for the post of Second Assistant Station Chemist at High Marnham Power Station, nr. Newark, Notts.

Candidates should be experienced in the analysis and testing of coal, oil and water, and in the application of the results to high-pressure plant. Candidates should also hold the Higher National Certificate in Chemistry or its equivalent.

Salary and conditions of service in accordance with Class N, Grade 11 (£1,275/£1,410 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 28 April, 1961.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent concerned and should be returned to him by the date stated.

O. S. WOODS,
Divisional Controller.
(A 378)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

No. 1 Sub-Area

SENIOR DEMONSTRATOR

REQUIRED in the Liverpool South District. Salary within range £700/£775 per annum (N.J.C. Grade 2).

Candidates should have previous experience as a Demonstrator, with a good knowledge of electrical household appliances, and be competent to supervise demonstrations on cooking, laundering and housecraft subjects. Possession of a recognised Diploma in Domestic Science or other approved qualification is desirable.

Excellent annual holiday and sick pay schemes. Appointment subject to medical examination.

Standard application forms, obtainable from the Manager, No. 1 Sub-Area, 24 Hatton Garden, Liverpool 3, should be returned not later than 28 April, 1961.
(A 367)

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

ASSISTANT SHIFT CHARGE ENGINEER
POOLE GENERATING STATION
SEC/3.143.

APPLICANTS should have had previous experience in a modern generating station, preferably one with high operating temperatures and pressures.

Preference will be given to those possessing qualifications leading to Corporate Membership of a recognised professional engineering institution or equivalent qualifications.

Salary: N.J.B. Scale 11, Grade K.8, £1,275/£1,410, plus shift allowance.

Special applications forms (not AE6/ACT) obtainable only from Divisional Secretary, 111 High St, Portsmouth, should be returned by 26 April, 1961.

GRADE 12 ENGINEER
MARCHWOOD GENERATING STATION
SEC/3.144.

The person appointed may be required to undertake shift operational duties, or perform general station duties. Previous experience of modern generating station plant is desirable.

Applicants should have had a sound technical training and preferably possess qualifications leading to Corporate Membership of an appropriate professional institution or hold equivalent qualifications.

Salary: N.J.B. Scale 8, Grade L.12, £1,040/£1,165.

Special application forms, obtainable only from Divisional Secretary, 111 High St, Portsmouth, should be returned by 25 April, 1961.
(A 376)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Combined Control Centre.
South Staffs and North Worcs and Wolverhampton Areas

THIRD ASSISTANT ENGINEER
(SHIFT CONTROL)
(Ref. SS/T/500)

The successful applicant will be responsible to the Second Assistant Engineer (System Control) for directing and supervising district and area staffs in the operation of the distribution system. Applicants should have a good knowledge of system operation and loading. Experience in the operation of supervisory controlled substations an advantage. Salary: £1,350/£1,500 per annum (N.J.B. Grade N.10), plus shift allowance.

FOURTH ASSISTANT ENGINEERS
(SHIFT CONTROL)
(Ref. SS/T/499)

The successful applicants will be required to assist the Third Assistant Engineers (Shift Control). Salary: £1,115/£1,245 per annum (N.J.B. Grade N.13), plus shift allowance.

Apply, by letter, within 14 days, stating age, present position and salary, and giving full particulars of qualifications and experience and quoting the appropriate reference number, to Mr D. Holt, Acting Area Manager, Midlands Electricity Board, P.O. Box No. 9, Toll End Rd, Tipton, Staffs.

Wolverhampton Area

THIRD ASSISTANT DISTRICT ENGINEER
(LICHFIELD)

Applicants should have had experience in the Construction and Maintenance of high and medium voltage distribution systems. Technical qualifications desirable. Salary: £825/£940 per annum (N.J.B. Grade E.9).

GENERAL ASSISTANT DISTRICT
COMMERCIAL ENGINEERS (CANNOCK)

Applicants should have had experience in one or more of the following commercial activities. (1) Preparation of specifications and estimates; (2) repairs to consumers' apparatus and associated wiring; (3) negotiations of new supplies, application of tariffs and public lighting installations and maintenance. Technical qualifications desirable. Salary: £715/£805 per annum (N.J.B. Grade F.12).

Apply, by letter, within 14 days, stating age, experience, present position and salary to Mr D. Holt, Area Manager, Midlands Electricity Board, 83 Darlington St, Wolverhampton.

F. W. CATER,
Secretary.
(A 348)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Ayrshire Area

THIRD ASSISTANT ENGINEER
(SHIFT CONTROL)

APPLICATIONS are invited for the above post at Area Headquarters, Kilmarnock.

Applicants should have had previous experience of control room work involving an extensive distribution network up to 33 kV. Preference will be given to applicants holding a Higher National Certificate in Electrical Engineering.

The salary for the post, which is superannuable, will be in accordance with the N.J.B. Agreement, Scale 9, Class K, Grade 10, £1.115/£1,245 per annum, plus 10% shift allowance.

Application forms, which may be obtained from G. F. Moore, Manager, Greenholm St, Kilmarnock, should be received not later than 28 April, 1961. (A 363)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Fife Area

SECOND ASSISTANT ENGINEER
CONSTRUCTION

APPLICATIONS are invited for this post at Area Headquarters, Dunfermline. Applicants should have practical experience of construction of lines and substations up to 33 kV, and preferably hold technical certificates leading to Corporate Membership of the I.E.E.

Conditions of employment in accordance with N.J.B. Agreement; present classification and Grade J.7 (Scale 11); present salary £1,275/£1,410 per annum; post superannuable subject to satisfactory evidence of health.

Applications on standard form, obtainable from Area Manager, S.S.E.B., East Port, Dunfermline, should be returned not later than 26 April, 1961. (A 373)

CAMERON HIGHLANDS HYDRO-ELECTRIC SCHEME, MALAYA.

ASSISTANT
ELECTRICAL ENGINEER

REQUIRED by Consulting Engineers for Site Construction Staff, Assistant Electrical Engineer to oversee the erection and setting to work of two or more 132 kV stepdown substations.

The work would be entirely in the field and under the directions of the Resident Engineer (Transmission).

Applicants should be corporate members of one of the Senior Institutions and have experience of work of a like character.

The appointment would be for approximately 18 months with provision for extension, commencing in August, 1961. Passages provided, free medical attention, transport allowance, concessionary housing. Salary in the range £2,900/£3,300 p.a. according to qualifications.

Applications should be made in writing within 14 days of the publication of this advertisement plainly marked ARE(T), giving full details of qualifications, previous experience, age, marital status, etc., to Preece, Cardew and Rider, Consulting Engineers, 8, 10 and 12 Queen Anne's Gate, London S.W.1. (A 352)

YORKSHIRE ELECTRICITY BOARD

No. 4 (Leeds) Sub-Area

SENIOR ASSISTANT ENGINEER
(CONSTRUCTION)

APPLICANTS should have wide experience in programming and supervising construction work for substations, buildings and underground/overhead networks in industrial, urban and rural areas, together with ability to take administrative control, under the Sub-Area Engineer, of the Construction Section. Preference will be given to corporate members of the Institution of Electrical Engineers or to applicants with equivalent qualifications.

Salary: N.J.B. Class L, Grade 4 (Scale 16), £1,795/£1,950 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Leeds, not later than 28 April, 1961.

No. 2 (Huddersfield) Sub-Area

SECOND ASSISTANT COMMERCIAL
ENGINEER
(SERVICE CENTRES, PUBLICITY AND DOMESTIC SALES)

The duties comprise responsibility to the Sub-Area Commercial Officer for all aspects of domestic development. Candidates should

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have considerable experience in the control of Service Centres, window and interior display, publicity, direct mail, exhibitions, demonstrations, and possess ability and enthusiasm for appliance sales promotion.

Salary: N.J.B. Glass L, Grade 7 (Scale 13), £1,440/£1,610 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market St, Huddersfield, not later than 28 April, 1961.

No. 3 (Sheffield) Sub-Area

SHEFFIELD EAST DISTRICT
SECOND ASSISTANT DISTRICT ENGINEER

Applicants should possess technical qualifications equivalent to Corporate Membership of the Institution of Electrical Engineers and be experienced in the working of an electricity supply District.

Experience in the operation, maintenance and construction of substations and mains, both overhead and underground, and in the planning and estimating of development schemes on an electricity distribution system with voltages up to 33 kV will be an advantage.

Salary: N.J.B. Class J, Grade 7 (Scale 11), £1,275/£1,410 per annum.

SHEFFIELD CENTRAL DISTRICT
THIRD ASSISTANT DISTRICT ENGINEER

Applicants should have technical qualifications equivalent to Graduate Membership of the Institution of Electrical Engineers and should have had experience in the work of a District Engineering Department, including construction, operation, maintenance and planning.

Sheffield, despite its heavy industries is on the edge of the Peak National Park with attractive residential areas.

Salary: N.J.B. Class H, Grade 9 (Scale 8), £1,040/£1,165 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial St, Sheffield 1, not later than 28 April, 1961.

No. 1 (Bradford) Sub-Area

FOURTH ASSISTANT ENGINEER
(CONSTRUCTION)

Applicants should be Graduate Members of the Institution of Electrical Engineers or hold equivalent qualifications.

They should be capable of planning and supervising work in connection with the design and construction of H.V. overhead and underground networks up to and including 33 kV. They will also be required to assist other Engineers in supervising construction work in progress at primary substations.

Salary: N.J.B. Class L, Grade 13 (Scale 7), £965/£1,090 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53 Sunbridge Rd, Bradford 1, not later than 28 April, 1961 (A 364)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Region

APPOINTMENT OF REGIONAL PERSONNEL OFFICER

Vacancy No. MR. 154.

APPLICATIONS are invited for the post of Regional Personnel Officer in the Midlands Region of the Central Electricity Generating Board. The duties will include the interpretation and application of National Agreements, negotiations with the Trade Unions, recruitment, selection and appointment of staff, development of a Careers Policy, welfare, canteens, etc.

The appointment will be made within the salary range £3,515/£3,765 per annum.

Knowledge of the organisation of the Electricity Supply Industry would be an advantage but is not essential.

Applications from suitably qualified persons, quoting the above Vacancy No., should be addressed to the Regional Director, Midlands Region, 53 Wake Green Rd, Moseley, Birmingham 13, marked "Confidential," and should arrive not later than Monday, 1 May, 1961. (A 371)

BUCKINGHAMSHIRE EDUCATION COMMITTEE

High Wycombe College of Further Education

PRINCIPAL: D. J. EVERETT, B.A., F.F.T. COM.

APPLICATIONS are invited from suitably qualified men for the post of

MAINTENANCE ENGINEER

to be responsible for:

(i) General maintenance of premises and equipment.

(ii) Maintenance of central heating and domestic hot water systems, gas systems, extractor ventilation, electric power installations, water pressure pumps, compressed air machines, etc.

The person appointed will be responsible to the Principal subject to the maintenance of the fabric of the building and of its services being carried out under the general direction of the County Architect.

Salary will be paid on the scale £815/£960 per annum, and the post will be superannuable.

For further details and forms of application, prospective candidates should forward a stamped addressed envelope to the Principal, College of Further Education, Queen Alexandra Rd, High Wycombe. (A 362)

THE NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified engineers for the following appointments which are subject to the conditions of the National Joint Board.

Tees Sub-Area

DISTRICT COMMERCIAL ENGINEER
STOCKTON DISTRICT

Applicants should have experience in the utilisation of electrical energy in commercial and domestic premises, knowledge of installation work and be conversant with tariffs, sales and all aspects of consumer service. Duties of the post include responsibility for commercial administration of the District, control of two Service Centres, contracting and consumer service arrangements.

Salary: Schedule A, Class G, Grade 3, £1,440/£1,610 per annum.

York Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER
YORK DISTRICT

Applicants should have experience on high and low voltage, urban and rural, overhead and underground distribution systems.

Salary: Schedule A, Class G, Grade 9, £965/£1,090 per annum.

Applications, stating age, qualifications and experience, to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne 1, within ten days of the appearance of this advertisement. (A 366)

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT DISTRICT ENGINEER
TWICKENHAM AND RICHMOND DISTRICT

SALARY: £1,040/£1,165 p.a. plus London allowance under N.J.B. Class F, Grade 7. (Re-classification to Class G pending). Superannuable. Preference given to applicants with technical qualifications up to H.N.C. standard and with practical experience of the planning, construction, operation and maintenance of MV and 11 kV underground systems. Consideration will be given to a private car allowance and assistance in house purchasing in appropriate circumstances. The successful applicant will be required to undertake standby duties.

Applications, quoting ET, on forms from District Manager, Seeboard, 42 York St, Twickenham, Middlesex, by 26 April, 1961.

ASSISTANT DISTRICT ENGINEER
GUILDFORD DISTRICT

Salary: £1,040/£1,165 under N.J.B. Class F, Grade 7. Superannuable. Preference given to applicants with technical qualifications up to H.N.C. standard and with practical experience of the planning, construction, operation and maintenance of MV and 11 kV underground and overhead systems. Consideration will be given to a private car allowance and assistance in house purchasing in appropriate circumstances. The

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successful applicant will be required to undertake standby duties.

Applications, quoting ET, on forms from District Manager, Seeboard, Woodbridge Rd, Guildford, Surrey, by 26 April, 1961.

OVERHEAD LINESMAN (UP TO 30,000 VOLTS)
CRAWLEY AND HORSHAM DISTRICT

Applicants should be experienced in the erection and maintenance of wood pole HV and MV overhead lines. Wages: 5s 4½d per hour for a 42-hour 5-day week under N.J.I.C. Agreement.

Applications, quoting ET, and naming two referees to District Manager, Seeboard, 50/52 The Broadway, Crawley, Sussex, by 24 April, 1961.

GEORGE WRAY,
Secretary.
(A 374)

SURREY EDUCATION COMMITTEE

Kingston Technical College, Fassett Road, Kingston-upon-Thames.

REQUIRED 1 Sept., 1961:

(1) SENIOR LECTURER IN ELECTRICAL ENGINEERING

Should possess degree in Electrical Engineering and appropriate professional qualifications, together with teaching and industrial or research experience, and be prepared to teach to final year degree and Part III I.E.E. level, mainly in Electric Power.

(2) AND (3) TWO LECTURERS IN ELECTRICAL ENGINEERING

Should possess degree in Electrical Engineering and appropriate professional qualifications, preferably with teaching and industrial or research experience and be prepared to teach to final year H.N.D. level in wide range of Electrical Engineering subjects; one with a preference for heavy current engineering and one for light current engineering.

Salary: Burnham Technical Scale, Senior Lecturer: £1,550 x £50—£1,750; Lecturer: £1,370 x £35(4)/£40—£1,550, plus London Allowance.

Application forms and further particulars from Principal, to be returned as soon as possible, in any case not later than 1 May, 1961. (A 347)

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

VACANCY NOTICE: ET/AV/38/61.

FOURTH ASSISTANT ENGINEER

REQUIRED in the Bristol District of the Divisional Electrical Department.

Superannuation Scheme. Salary: N.J.B. Class AX, Grade 9, Scale 9, £1,005/£1,245 per annum.

Possession of, or studying for, qualifications leading to Corporate Membership of the Institution of Electrical Engineers or an equivalent qualification would be an advantage.

Practical works experience in manufacture, testing and/or protection of electrical plant is required along with a knowledge of site erection or commissioning procedure on high voltage transmission equipment.

VACANCY NOTICE: ET/AV/39/61.

FOURTH ASSISTANT ENGINEERS

Required in the Bristol and Taunton Districts of the Divisional Electrical Department.

Superannuation Scheme. Salary: N.J.B. Class AX, Grade 11, Scale 7, £855/£1,090 per annum.

Possession of, or studying for, qualifications leading to Corporate Membership of the Institution of Electrical Engineers or an equivalent qualification would be an advantage.

Knowledge of manufacture and testing of light or heavy electrical equipment associated with the Generating Board's high voltage transmission system will be an advantage. Alternatively, previous training on transmission system within the Industry.

Applications on Form AE6/ACT obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 25 April, 1961. (A 365)

THE NORTH WESTERN ELECTRICITY BOARD

SECOND ASSISTANT DISTRICT ENGINEER
LEIGH DISTRICT

THE duties will be to assist the District Engineer in the construction, operation and maintenance of the 33 kV, 11 kV and low voltage distribution systems.

The successful applicant will be responsible for a section of the District and should be prepared to undertake standby duties.

Applicants should preferably be Corporate Members of the Institution of Electrical Engineers.

Salary Scale: £1,275/£1,410 p.a. Grade J.7. N.J.B. Conditions.

Applications on forms to be obtained from the Manager, No. 2 Sub-Area, The North Western Electricity Board, 2 St. George's Rd, Bolton, and returned to him by 26 April, 1961.

FOURTH ASSISTANT DISTRICT ENGINEER
BURNLEY DISTRICT

The duties will include assistance in the operation, maintenance and construction of substations and H.V. and L.V. underground and overhead mains, fault location and the general maintenance of supply in the District. The successful applicant will be required to undertake standby duties.

Preference will be given to applicants who hold the H.N.C. in Electrical Engineering.

Salary Scale: £890/£1,015 p.a. Grade H.11. N.J.B. Conditions.

Applications on forms to be obtained from the Manager, No. 5 Sub-Area, The North Western Electricity Board, Jubilee St, Blackburn, and returned to him by 22 April, 1961. (A 343)

CENTRAL ELECTRICITY GENERATING BOARD

PERFORMANCE ANALYSIS ENGINEER

REQUIRED in the Operational Efficiency Branch of the Operations Department at Headquarters, London E.C.1.

The Engineer appointed will be required to organise and direct the work of a small section concerned with the introduction and continuous development of methods of monitoring the day-to-day efficiency of operation of the Board's national grid system as a whole. The effective integration of the work done in the Regions on monitoring their part of the system will form an important part of the initial development.

The successful candidate will be required to co-ordinate the work of two associated sections concerned with statistical analysis of operation data and the application of established methods of budgetary control and standard costing as applicable to operations.

The work calls for original and clear thinking over a wide field, and an ability to identify and develop solutions to intricate and non-routine problems. An honours degree or its equivalent would be an advantage, coupled with recent experience in the generation side of the supply industry. The position offers scope for a person of ability.

Salary within the range £2,440/£2,655 p.a.

Applications stating age, experience, present position and salary, to the Appointments Officer, 24-30 Holborn, London E.C.1., by 28 April, 1961. Quote Ref. ET/158. (A 375)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

No. 2 Sub-Area

ASSISTANT SECTION ENGINEER

REQUIRED in the St. Helens District. Salary within range £1,040/£1,165 per annum (N.J.B. H/9).

Applicants should have received an engineering training and have experience in H.V. and M.V. overhead and underground distribution work. Technical qualification desirable.

Appointment subject to medical examination. Pension scheme.

Standard application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway Hse, Northwich, Cheshire. Closing date: 20 April, 1961. (A 336)

Ferranti

West Gorton

MANCHESTER

have vacancy for a

DISTRIBUTION TRANSFORMER DESIGNER

Applicants should preferably have experience of transformers up to 1,500 kVA and should have a degree or H.N.C. in Electrical Engineering. Consideration would, however, be given to applicants holding the requisite qualification but without transformer experience, and who are seeking design experience.

Application forms can be obtained from T. J. Lunt, Staff Manager, Ferranti Ltd., Hollinwood, Lancs. Please quote reference TM. (A 356)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Region

APPOINTMENT OF REGIONAL PUBLIC RELATIONS OFFICER

Vacancy No. MR. 155.

APPLICATIONS are invited for the post of Regional Public Relations Officer in the Midlands Region of the Central Electricity Generating Board at Birmingham.

The successful applicant will be on the staff of the Regional Secretary and the duties will include press relations, internal and external information services, production of booklets, posters, etc.; the preparation or collection of material for lectures, conferences and exhibitions, the organisation of visits and the reception of visitors and various other publicity matters throughout the Region.

The appointment will be made within the salary range £1,965/£2,170 per annum.

A knowledge of the organisation of the Electricity Supply Industry would be an advantage, but it is not essential. Applications from suitably qualified persons, quoting the above Vacancy No., should be addressed to the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, Midlands Region, 53 Wake Green Rd, Birmingham 13, marked "Confidential," to arrive not later than Monday, 1 May, 1961. (A 372)

BUCKINGHAMSHIRE EDUCATION COMMITTEE

High Wycombe College of Further Education

PRINCIPAL: D. J. EVERETT, B.A., F.F.T. COM.

APPLICATIONS are invited for the following post for September next:

ENGINEERING DEPARTMENT

ASSISTANT GRADE B

To teach students taking City and Guilds Electrical Installation Courses. Ability to teach students in O.N.C. courses will be an advantage. Applicants should hold appropriate City and Guilds or equivalent qualifications and have had teaching and/or good industrial experience.

Salary in accordance with the Burnham Further Education Report, viz., £700 x £27 10s—£1,150, plus additions for approved qualifications and training.

Application forms and further particulars may be obtained from the Principal, College of Further Education, Queen Alexandra Rd, High Wycombe, to whom completed forms should be returned within 14 days of the appearance of this advertisement. (A 361)

J. & P.

WORKS SUPERINTENDENT

TRANSFORMER DEPT.

Applications are invited from suitably qualified men for the post of Superintendent of a Works producing transformers up to 45 MVA 132 kV. This is an interesting and permanent appointment with good prospects. The Company offers good holiday and sick pay conditions and operates a Superannuation Scheme.

Applications, which will be treated in confidence, giving details of qualifications, experience, age and present salary, should be addressed to the Employment Manager, Johnson and Phillips Ltd., Charlton, London, S.E.7. (A 387)

SOUTH WESTERN ELECTRICITY BOARD

SECOND ASSISTANT ENGINEERS (PLANNING) (TWO)—SOMERSET GROUP

SALARY within Class J, Grade 8, Salary Scale 10, £1,190/£1,325 per annum, of the N.J.B. Agreement.

The person appointed will be required to undertake planning and the preparation of schemes and estimates for the extension and reinforcement of the distribution systems, both overhead and underground.

Candidates should have a wide experience of planning, construction and operation of distribution systems and a knowledge of budget preparation and long-term forecasting.

Qualifications equivalent to Corporate Membership of the Institution of Electrical Engineers are most desirable.

Applications to be made on Standard Form AE6/ACT, OBTAINABLE BY POSTCARD ONLY, from the Group Administrative Officer, South Western Electricity Board, Priorswood Rd, Taunton. Closing date for receipt of completed applications is 29 April, 1961.

FOURTH ASSSISTANT DISTRICT ENGINEER TAUNTON—OUTPOSTED AT BRIDGWATER

Salary within Class G, Grade 11, Salary Scale 5, £825/£940 per annum, of the N.J.B. Agreement.

The successful candidate will be outposted at Bridgwater and will be required to assist generally in the Engineering Department on construction, operation and maintenance of the distribution system up to and including voltages of 33 kV, under the outposted Engineer in Charge, at Bridgwater. The candidate appointed will be required to undertake standby duties on a rota basis.

Duties will normally be in the Bridgwater area, but the successful candidate may be required to work anywhere within the Taunton District.

Candidates should have experience in the erection and maintenance of overhead and underground H.V. and L.V. networks including substations and should have previous experience of operating systems up to and including 33 kV. The possession of the Ordinary National Certificate in Electrical Engineering is desirable.

Applications to be made on Standard Form AE6/ACT, OBTAINABLE BY POSTCARD ONLY from the District Manager, South Western Electricity Board, The Parade, Taunton. Closing date for receipt of completed applications is 29 April, 1961. (A 338)

ENGLISH ELECTRIC

STAFFORD

invite inquiries from

TECHNOLOGISTS and TECHNICIANS

who would like to make contributions at various relevant levels to a number of

DEVELOPMENT PROJECTS

(1) Power System studies using analogue computer, network analyser and other similation techniques.

(2) Transducer applications for stress and vibration analysis.

(3) Fundamental investigations into:
- (a) Mechanical problems, and
- (b) Dielectric properties of materials.

(4) Development and proving tests on the performance of high power and electrical equipment.

(5) Investigations on electrical insulating materials and processes, with particular reference to development and use of electrical measuring techniques.

All these posts, while being primarily concerned with serving Stafford Works, also serve the Company in general and an appreciable part of the work is done on a group basis.

The posts are all permanent and pensionable and applicants will be able to discuss accommodation and removal details at interview.

Applications should be sent, giving full details, to the Technical Staff Officer, English Electric Hse, Strand, London W.C.2, quoting Ref. ET 1295N.

(A 341)

DESIGNER-DRAUGHTSMAN

required, North West London area, knowledge in Electrical Wiring Accessories an advantage, good opportunity for right man. Apply, stating age, experience and references: Box No. 8257, Electrical Times. (A 346)

BACKER ELECTRIC COMPANY LIMITED

require a

DESIGN ENGINEER DRAUGHTSMAN

Applicants should preferably have experience of electric heating techniques as applied to domestic appliances and/or industrial equipment and be capable of leading and controlling a small drawing office staff engaged on the design and application of tubular sheathed electric heating elements.

Apply stating age, present salary and fullest details of qualifications, education and past experience to the Secretary, Backer Electric Company Limited, Fitzwilliam Rd, Rotherham. (A 385)

OVERHEAD TRANSMISSION LINE ENGINEERS

Large contracting organisation has vacancies in Scotland for Site Agent and Engineers of proved ability with experience of steel tower and wood pole Overhead Line Construction. Age and full details of experience to Box No. 662, Keith and Co., 137 Princes St, Edinburgh. (A 384)

REPRESENTATIVES

(Electric Heating)

E. K. Cole Ltd., Heating Division, have outstanding opportunities for ambitious representatives with experience and retail connections in the following areas: London, Home Counties, North England.

Write in confidence with full details to:

Mr. J. E. Woodward,
E. K. COLE LTD.,
5 Vigo St, London W.1.

(A 359)

DRAUGHTSMAN/DESIGNER

A fine opportunity occurs for a draughtsman with experience of space heating schemes, preferably with some electrical knowledge, to join the Heating Technical Advisory Team that planned such famous installations as those in Waltham Abbey Church and many other fine buildings as well as the World's greatest Ocean-going liners. Excellent working conditions. Pension scheme.

Write in confidence to:

Mr. G. R. Wibrow,
E. K. COLE LTD.,
5 Vigo St, London W.1.

(A 360)

Kodak

PLANNING ENGINEER

The successful applicant will be required to organise and co-ordinate large engineering projects. Applicants should have had a wide variety of experience in at least one of the following fields: Structural, Heating and Ventilating, Mechanical or Chemical Engineering, together with appropriate technical qualifications. Membership of a Senior Engineering Institution is desirable but not essential.

The Harrow factory employs 6,000 people of whom over 1,000 are located in the Engineering Division. Salary from £1,000 p.a. dependent upon experience and qualifications. Five-day week. Excellent employee benefits.

Apply: Men's Personnel Department,
Kodak Limited (Factories),
Wealdstone, Harrow, Middx.

(A 340)

J. & P.

ASSISTANT CHIEF DRAUGHTSMAN

SWITCHGEAR DEPT.

J. & P. Ltd. invite applications for the position of Assistant to Chief Draughtsman. Applicants must have practical and D.O. experience in Industrial Switchgear. Minimum qualifications H.N.C. Applications, stating age, training and experience, to: Employment Manager, Johnson and Phillips Ltd., Charlton, London S.E.7.

(A 345)

FOSTER WHEELER LIMITED

have immediate vacancies for

DESIGN DRAUGHTSMEN, DRAUGHTSMEN AND MATERIAL CONTROLLERS

for the Electrical Section of the Process Plants Division.

The work is in connection with Oil Refineries and Petro-chemical Plants and it is essential that applicants should have had experience of large industrial electrical installations.

These are permanent positions offering good salaries, commensurate with experience.

New offices, five-day week, Pension and Life Assurance Schemes, Luncheon Vouchers, Bonus Scheme.

We shall be pleased to arrange evening interviews.

Please write fully, giving age, qualifications and experience, and quoting Ref.: 59/AK, to: Office Manager, FOSTER WHEELER LTD., Foster Wheeler Hse, Chapel St, London N.W.1 (adjacent to Edgware Rd Station). (A 333)

APC

CONSTRUCTION ENGINEERS

A number of interesting vacancies have arisen with Atomic Power Constructions Limited for Construction Engineers at Head Office in London, at Trawsfynydd Nuclear Power Station in North Wales and also for future projects.

CIVIL ENGINEERS

One vacancy exists at Head Office and one at Trawsfynydd for suitably qualified Senior Civil Engineers who have had experience on the planning and/or construction of large industrial plants, preferably in the field of power generation. Less senior vacancies also exist for men with comparative experience.

MECHANICAL ENGINEERS

Two vacancies exist at Head Office and two at Trawsfynydd for engineers who are, preferably, members of the Institution of Mechanical Engineers and have experience in the planning of large industrial plants or have worked in the field on the erection of such plants.

ELECTRICAL ENGINEERS

Two vacancies exist in the planning section at Head Office and one at Trawsfynydd for Electrical Engineers who are experienced in power station practice and also have experience of E.H.T. switchgear and cable work.

INSTRUMENTATION AND CONTROL ENGINEERS

Qualified Electrical Engineers, who have specialised in control circuits, and instrumentation, are required to work initially at Head Office transferring to Trawsfynydd Power Station during the period of commissioning and initial operation.

These positions are on the pensionable staff and carry good prospects of advancement within the Company. In all cases, experience with nuclear power will be an advantage, but training will be arranged in nuclear techniques where necessary. Good salaries will be paid and generous allowances made to those engineers working at site.

Applications should be addressed to:

The Personnel Manager (Ref. ET/169),
Atomic Power Constructions Limited,
P.O. Box 90,
28 Theobalds Rd,
London W.C.1

(A 342)

AIR MINISTRY

ENGINEERING DESIGNER DRAUGHTSMEN REQUIRED IN LONDON

SALARY (inner London scale) Grade III, £658/£1,048 (£866 at age 25)—starting salary depends on age, quals. and exp.

Electrical Engineering Designer Draughtsmen experienced in preparation of schemes for illumination and electrical equipment of buildings or schemes for H.V. and M.V. electrical distribution (Grade III).

Candidates should have served a recognised apprenticeship or have had equiv. training and also adequate practical exp. Possession of recognised technical qualn. an advantage—financial assistance and time off may be allowed for recognised courses of study for technical quals. Five-day week with 18 days' paid leave p.a. initially. Promotion and pension prospects. Some overseas tours with special allowances in addition to salary.

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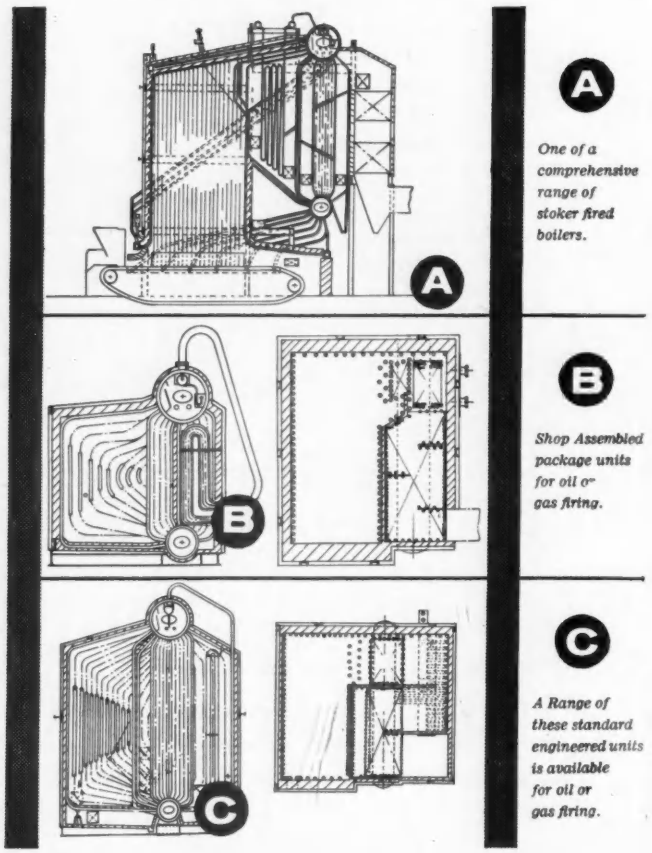

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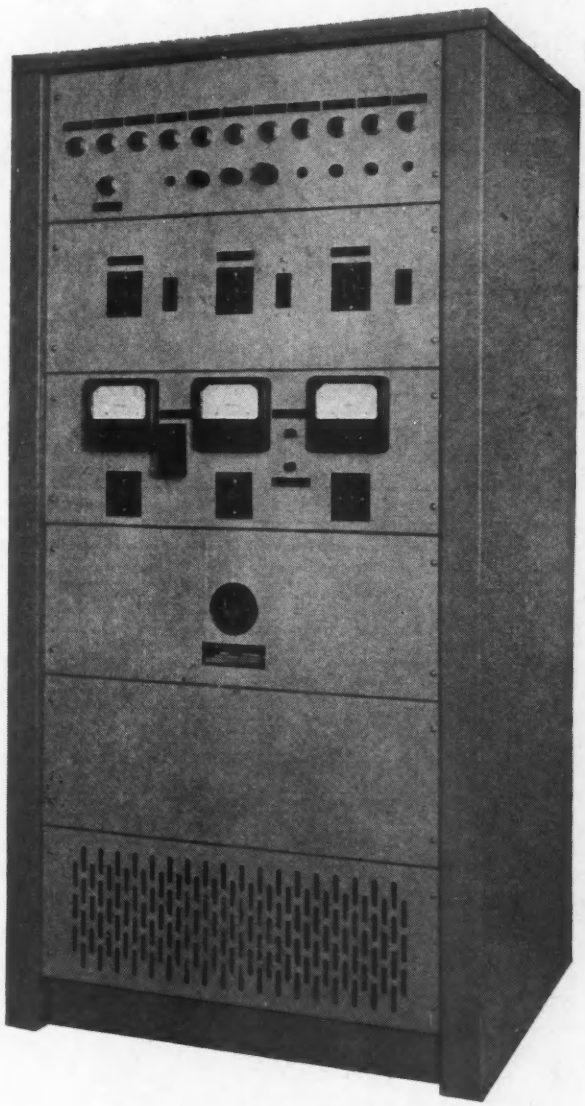

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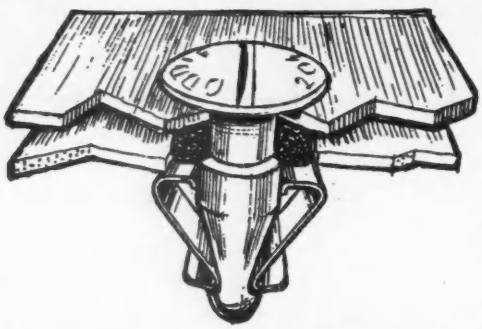

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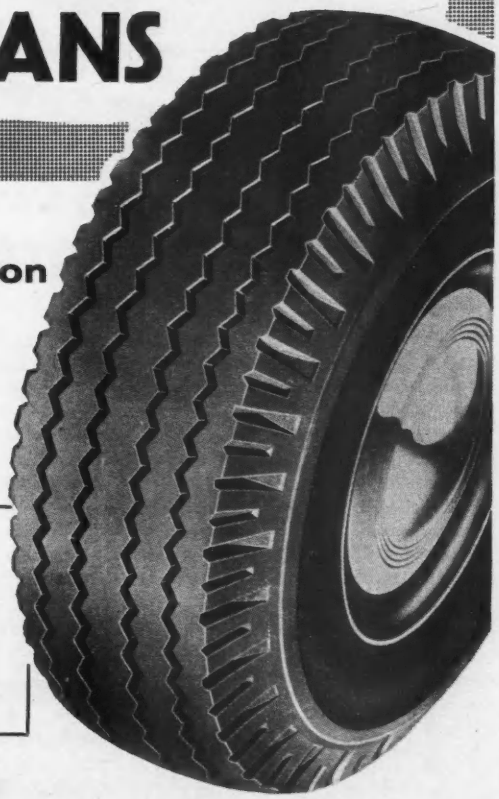

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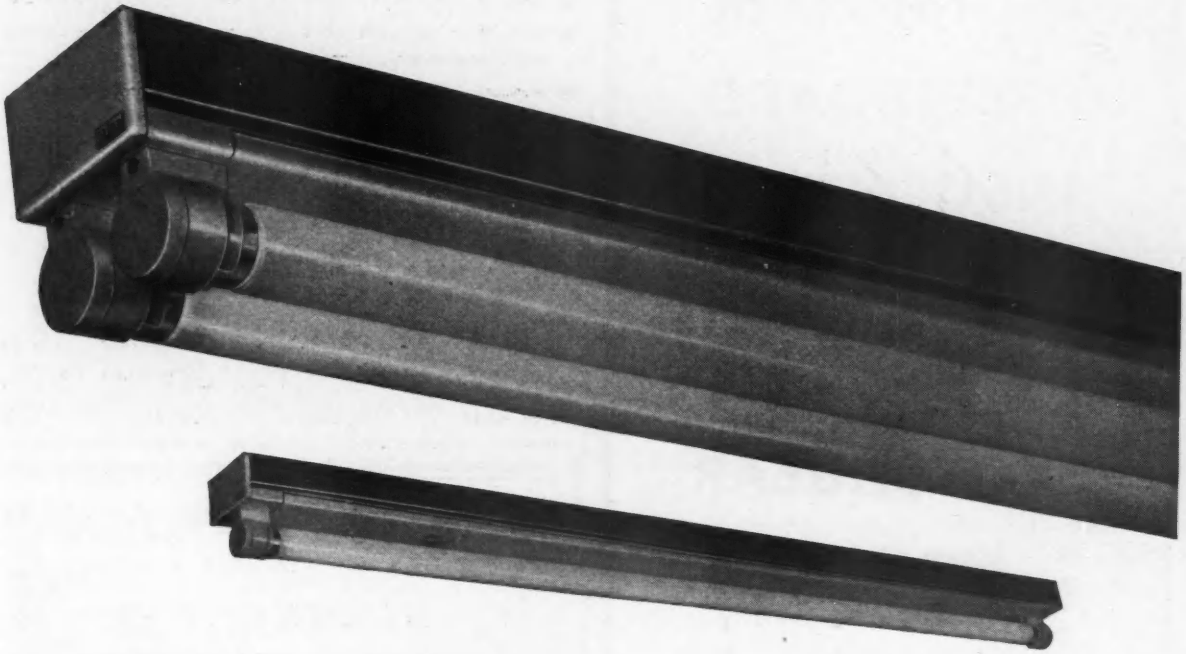

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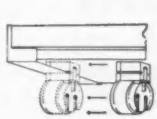

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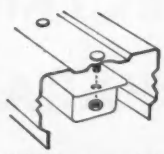

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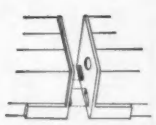

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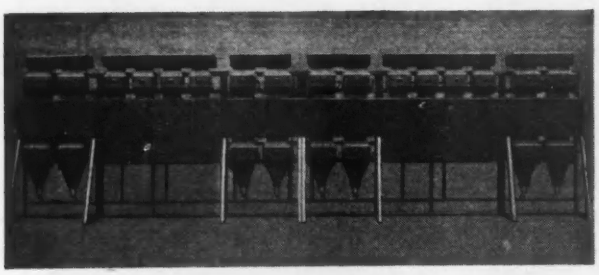

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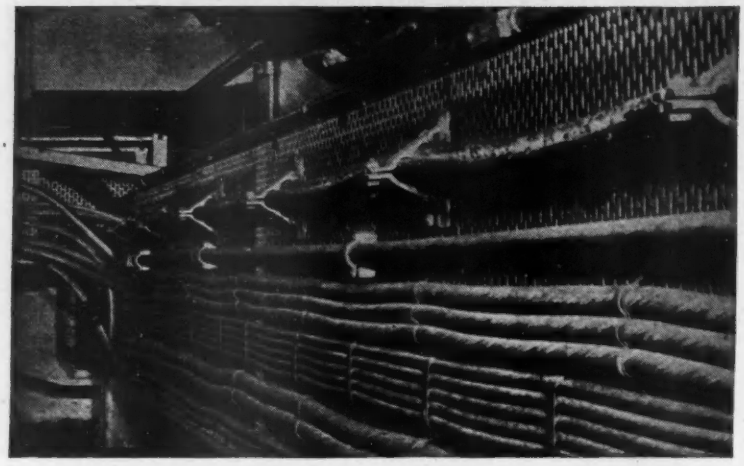

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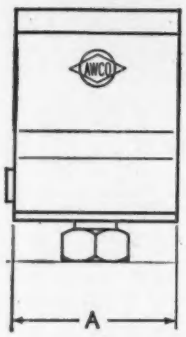
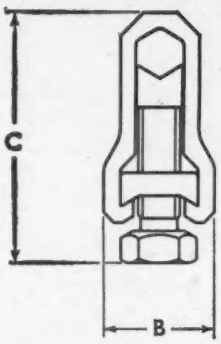
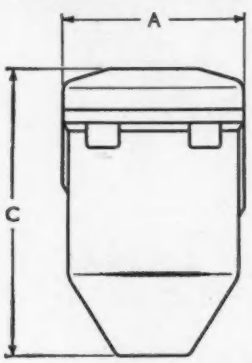


SADDLE TAP

For all-aluminium, ACSR and Silmalec† Conductors

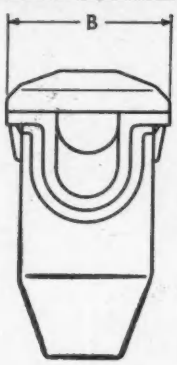


Catalogue Number	Main conductor diameter range	Maximum combined conductor diameters	A	B	C
	in.	in.	in.	in.	in.
ALT-1	0.177—0.366	0.732	1.300	0.875	2.375
ALT-2	0.367—0.558	1.038	1.875	1.175	3.250

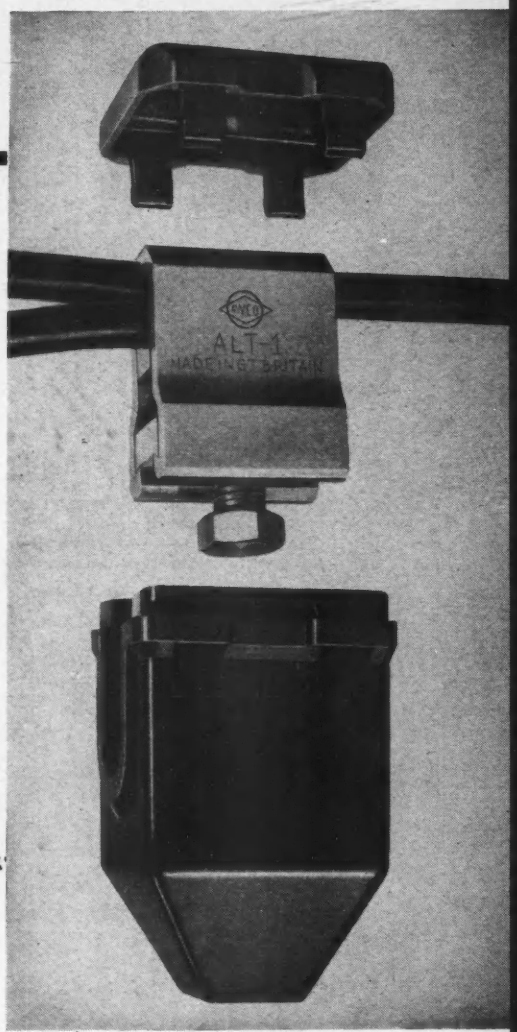


INSULATING SHROUD

For ALT-1 saddle tap*



Catalogue Number	A	B	C
	in.	in.	in.
LTS-1	1.813	1.625	2.734
*LTS-2	Insulating shroud for ALT-2 Saddle tap available shortly		



AWCO offer all types of **ALUMINIUM CONDUCTORS** for overhead electrification including all-aluminium, ACSR and Silmalec† conductors — both bare and plastic-covered. Write to us for publications describing these conductors and their accompanying accessories for line erection and maintenance.

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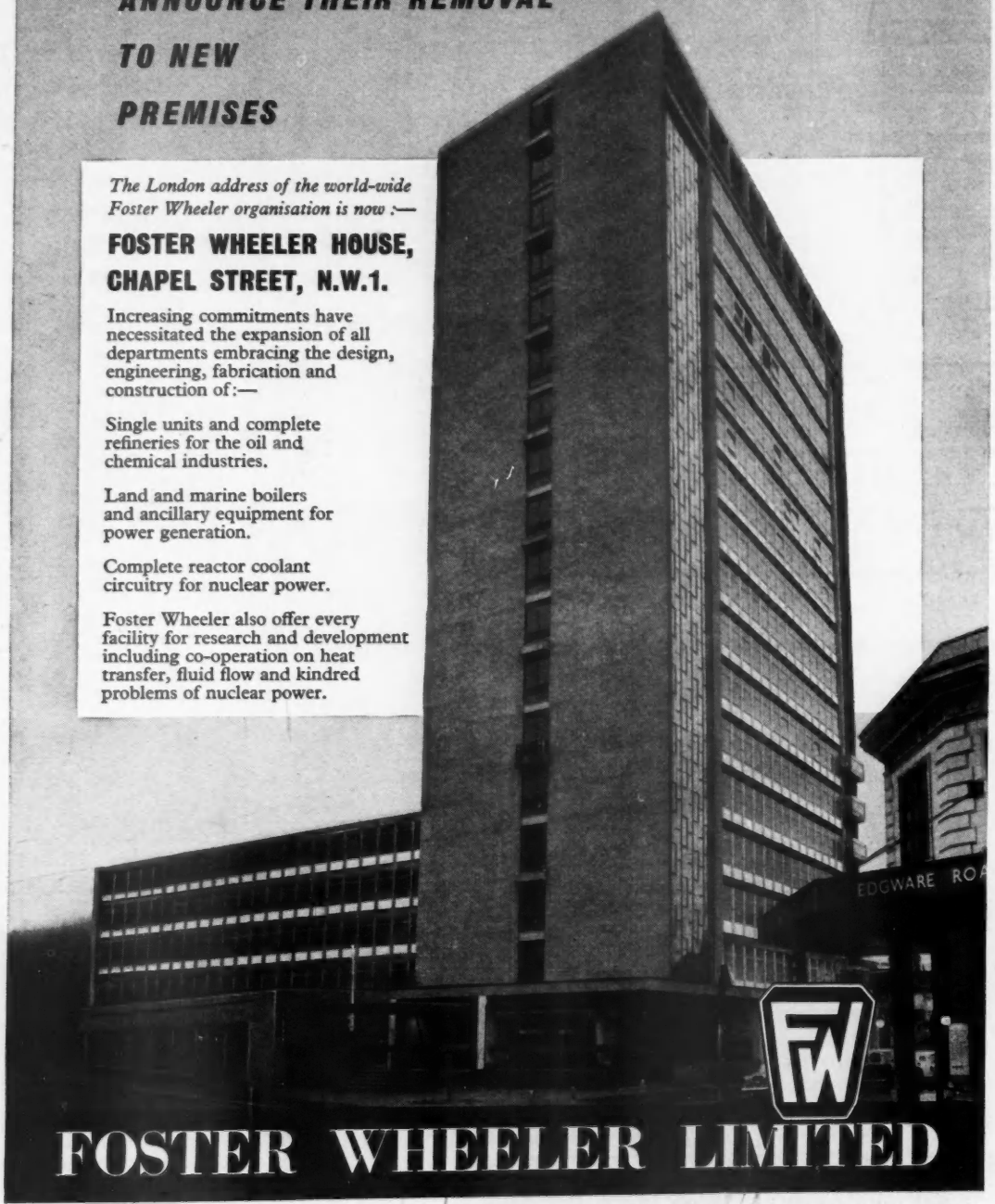

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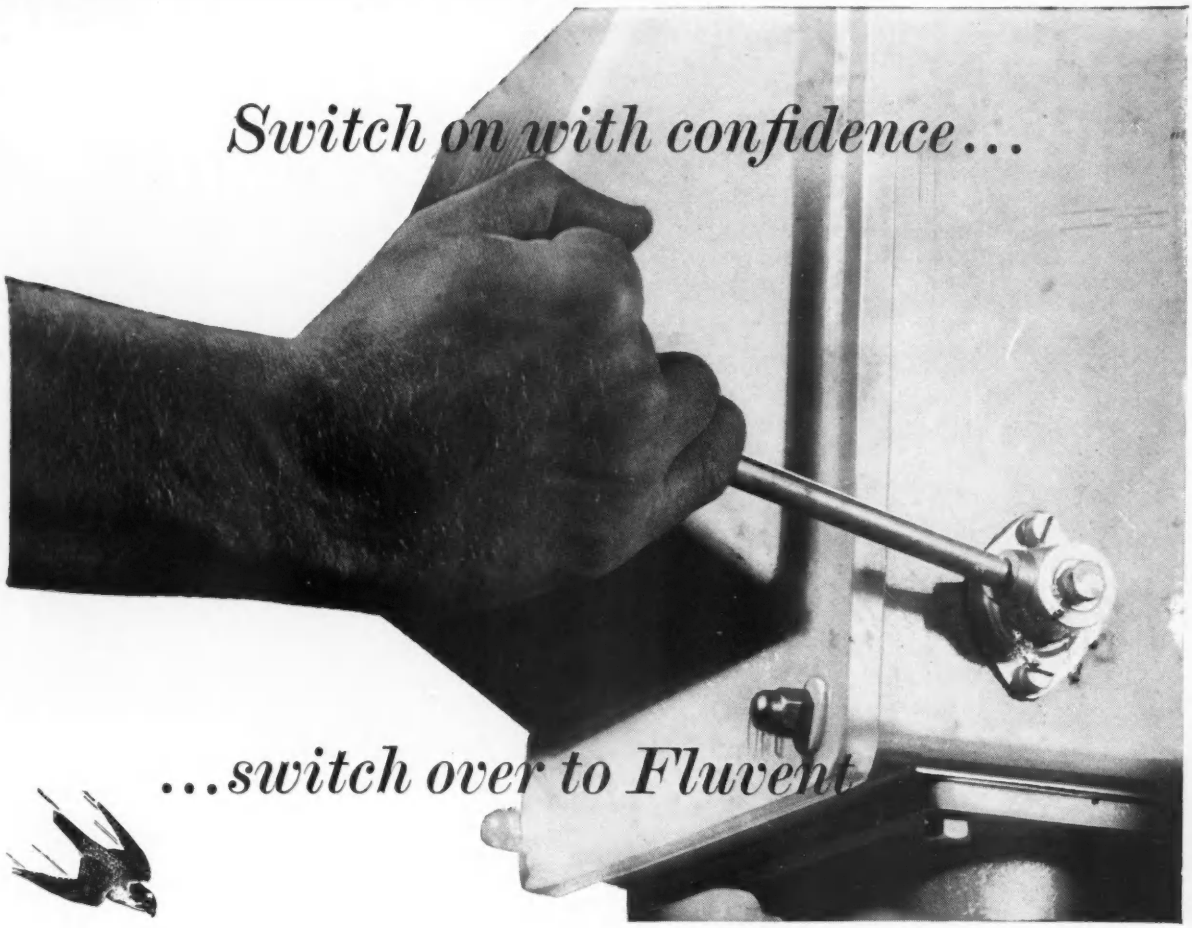
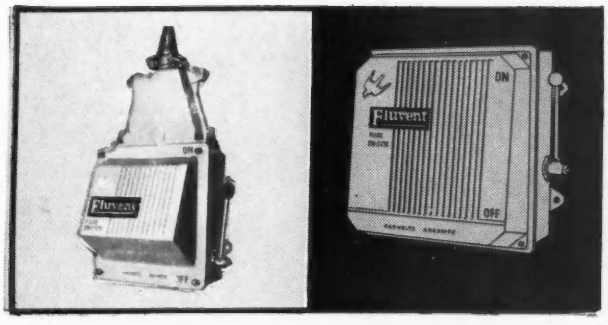
Printed in England by Gibbs & Bamforth Ltd., St. Albans, for the Proprietors, The Electrical Times Ltd., and published at Sardinia House, Sardinia Street, London, W.C.2.





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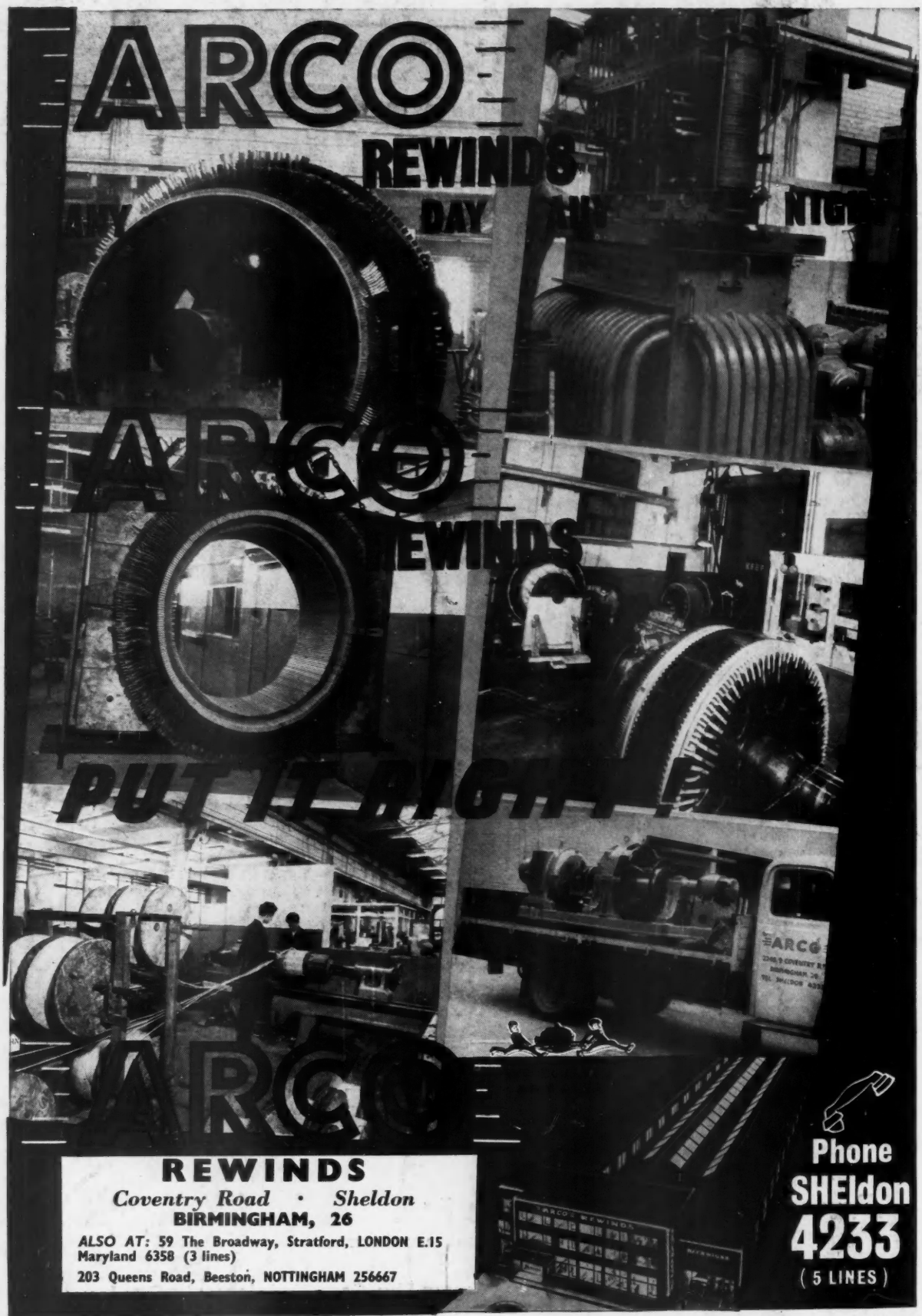
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